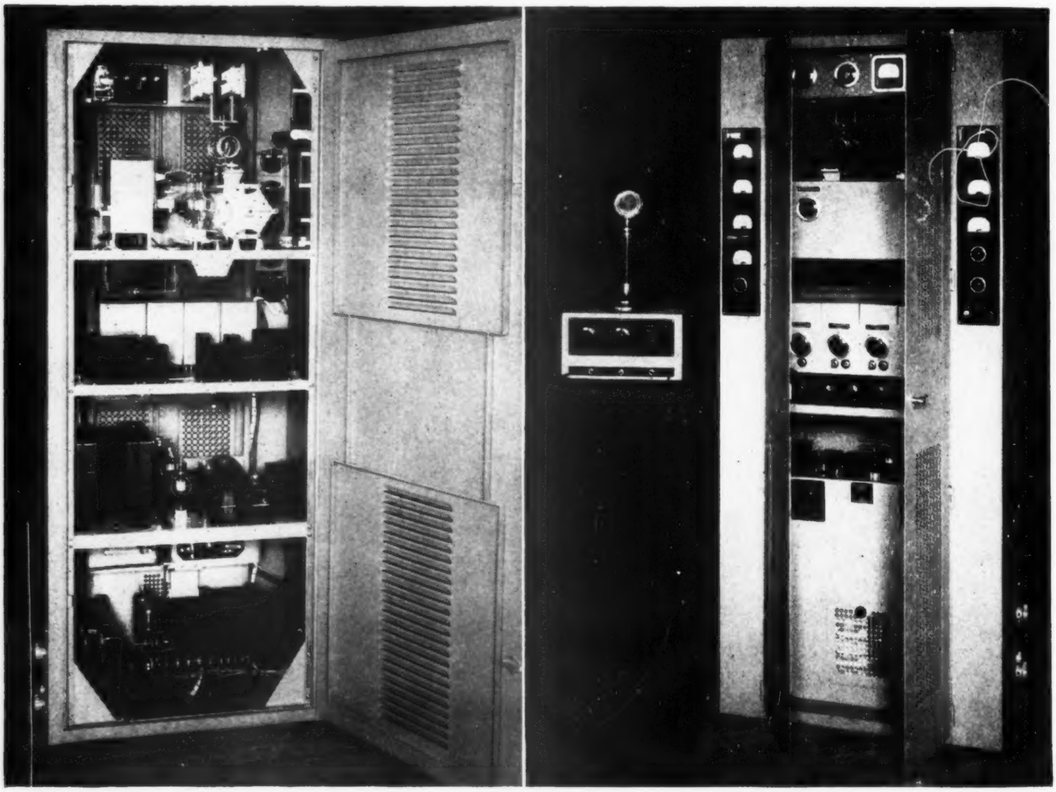
RADIO

June, 1937 | 30c in U.S.A. and Canada | No. 220
1/8 in the United Kingdom; 2/- in Australasia

This Month

VACUUM **EIMAC** TUBES

AN EXAMPLE OF THE INTELLIGENT APPLICATION OF THE NEWER PRINCIPLES OF TRANSMITTER DESIGN. THE STATION OF CHARLES M. SREBROFF W2BHY CHIEF ENGINEER OF RADIO ENGINEERING LABORATORIES, INC., LONG ISLAND CITY, N. Y.



QUOTING FROM A LETTER FROM W2BHY

"It might interest you to know that I have placed a transmitter on the air using a pair of 100TH tubes in the final, and these are modulated with another pair of 100THs in class "B" audio. The transmitter operates beautifully on 5, 10, and 20 meters. For 5 meter operation the final plate tank circuit comprises a pair of long lines. For 10 and 20 meters operation the final plate tank circuit uses the coil and condenser arrangement.

"The transmitter so far has been operated chiefly in the 10 meter phone band. It is arranged for high quality voice transmission, using audio parts which have a flat response from 70-7000 cycles. Every station worked comments on the terrific sock and beautiful quality. Eimac tubes are receiving wonderful comment.

"Incidentally the final is driven by a pair of 35Ts which operate as a straight amplifier for 10 and 20 meter operation and are operated as triplers for 5 meter operation.

"On 10 meters the 100THs in the final operate with an exact 1 KW input and under these conditions the tubes perform perfectly.

"Many of the stations worked marvel at the amount of power possible from a pair of 100THs."

EITEL-McCULLOUGH, INC.

San Bruno, California, U. S. A.

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORT WAVE, AND EXPERIMENTAL RADIO

RADIO

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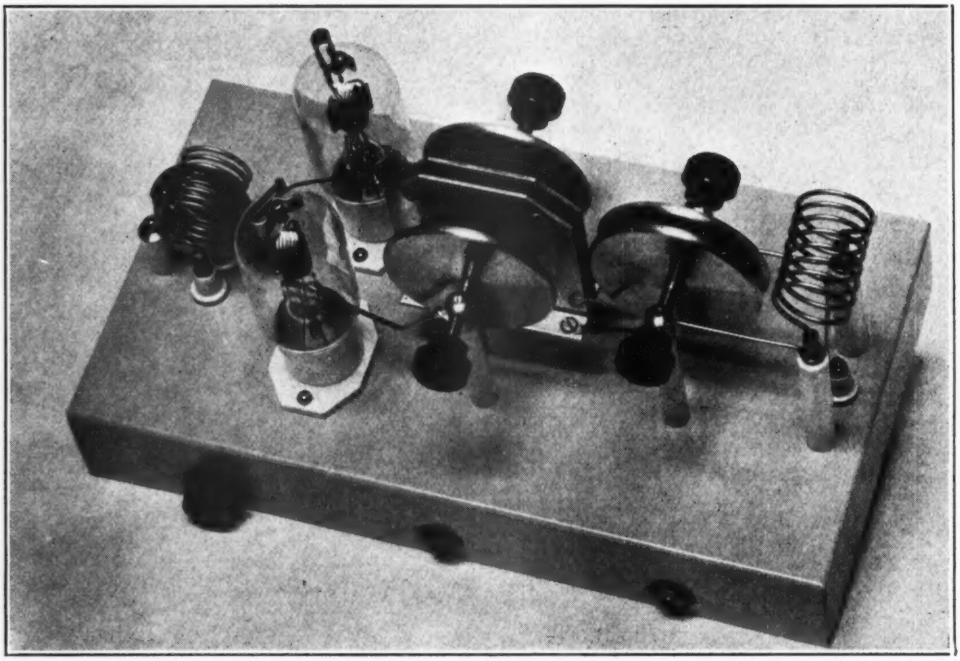
"RADIO" CONTRIBUTIONS

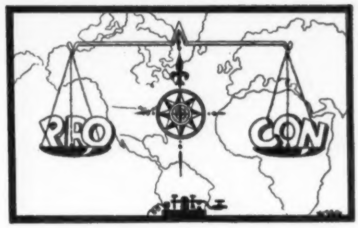
Contributions to our editorial pages are always welcome; though they will be handled with due care we assume no responsibility for those which are unsolicited; none will be returned unless accompanied by a stamped, addressed envelope. We do not suggest subjects on which to write; cover those you know best; upon request, we will comment on detailed outlines of proposed articles, but without committing ourselves to accept the finished manuscript.

Since we regard current "chiseling" policies as decidedly unfair, a small payment will be made, usually upon publication, for accepted material of a technical or constructional nature. Freehand, pencilled sketches will suffice. Good photographs add greatly to any article; they can easily be taken by the layman under proper instructions For further details regarding the taking of photographs and the submission of contributions see "Radio" for January, 1936, or send stamp for a reprint.



"SPECIALIZED" ULTRA HIGH FREQUENCY DESIGN. CONSTRUCTION STORY AND DETAILS IN THIS ISSUE.

THE OPEN FORUM



QRR, SOS, ETC.

Lake Bluff, Ill.

Sirs:

Plenty of articles have been written on transmitters to work dx, more of them on antennas to work dx, but hardly any at all on the procedure to *hook* those elusive YF's, HK's, and SU's. Will you please snag one of these guys who has made w.a.c. about 16 times, sit on his head and make him tell us how he does it?

I have been on the air for two years and the best dx I ever fished up was an XE who was working out of the band at the high frequency end of 20. If he hadn't been outside the QRM, I never would have heard him.

The rig and antennas here are all OK, I know, because I can raise anybody I can hear, but it is the receiving through 2001 W signals that has me licked. Do all successful dx'ers use Perrine supers? I don't think so; so find a w.a.c. that uses an SW3 and ask him what time he works his dx, how he can tell it is dx in the first place without trying every signal on the band and trusting to luck, and whether or not it is just pure luck to work a ZL. And while you're on the hunt, you might try to find a middle-western dx man who can work as much as one of the coastal boys.

"Osky" Kloer, W9SZB.

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OUT OF OUR HANDS

Tulsa, Okla.

Sirs:

While looking through my collection of QSL cards the other day, I noticed that out of a collection of several hundred cards, only a very small percentage bore the mark of being printed by a union concern.

It seems to me that, in the interest of advancing the rights and welfare of the laboring man, we should patronize the union printers. Most of us will admit that the unions have done much to help us. We in turn should back them up. What do you say?

G. H. Kraft.

OUCH!

Dallas, Texas.

Sirs:

At the outset I'll say that the letter of Mr. Pohlman, W8PMB, and Mr. Bamberg, W8OPX, in March, 1937, issue of Radio prompts these remarks.

Like these two gentlemen I am a supporter of radio and the ARRL and so far have found no basis for the cheap "cracks" directed to the League and its officers. When your organization reaches the point where it is doing more for the Amateur than the League and is bigger and more representative of Amateur Radio than the League, then you will have a right to make your "smart cracks" if you then see fit. But you will probably then be too busy with your own business to be trying to take care of someone else's.

C. W. Worley, W5FNR

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160 METERS

Marion, Ind.

Sirs:

Your leading editorial in the May issue is very interesting; that is if it was intended to indicate that mention of the 1715-1800 kc. band being empty was new! I have been bringing that subject up in *QST* and elsewhere about once a year ever since the phones were chased off of 160 meters. In fact I just mentioned it again the other day in a letter to the Central Division Director.

But seriously, I have to disagree, and I think that nearly everyone who uses 160 will too, with the statement that the 160 meter c.w. band is not empty. It is the deadest spot on on the ham bands. Now the question that has been troubling a good many of us for the last few years is just this: *Why* were the phones chased out of this band? And, since c.w. stations have con-

[*Continued on Page 76*]

"By Popular Demand"

By John D. Kraus,* W8JK

The "Flat Top Beam" described in the March issue of "Radio" became so popular almost immediately that the author of the article has been flooded with various queries regarding the operation and different modifications of the system. In the accompanying article he goes into greater detail on some of the points and covers in addition several phases of operation and feed not mentioned in the first article.

The dimensions of an amateur's backyard usually determine the size of the antenna he puts up. The flat-top directive antenna described in the March RADIO[1] is small enough to be classed as a truly "backyard beam." In view of the apparent interest in this type of antenna system, it is believed that further discussion and a more detailed description of its operation may be in place.

Figure 1 shows the flat-top beam as described in March RADIO. It may be said to consist of two double-Zepp antennas spaced one-eighth of a wavelength and fed 180° out of phase. The directions of the currents in the antenna wires at a given instant are shown by the arrows on the wires. For convenience the antenna is actually constructed of two full-wave wires crossed at the middle, and fed by a two wire tuned line or by a matching stub at the points, F, F. The radiation from this array is maximum in both directions broadside to the antenna, as indicated in figure 1. The use of spreaders permits of supporting the antenna between two poles. The antenna of figure 1 we may call a two-section flat-top beam. It has a gain of about 6 decibels over a single half-wave antenna.

The length L of each leg of the flat-top is not critical. As a maximum its length should not be more than one-half wave. When L is one-half wavelength, a current node is present at each of the insulators 1, 2, 3, 4 (figure 1), and the cross-over wires of length 2M constitute part of the tuned feeder system. With a tuned stub as shown, the distance A plus M is equal to about one-quarter or three-quarters of a wavelength, depending on whether a one-quarter or a three-quarter wavelength stub is used. Thus, if the length L of the flat top wires is changed,

*Arlington Blvd., Ann Arbor, Michigan

[1] A Small But Effective Flat-Top Beam," J. D. Kraus, RADIO, March 1937, p. 56.

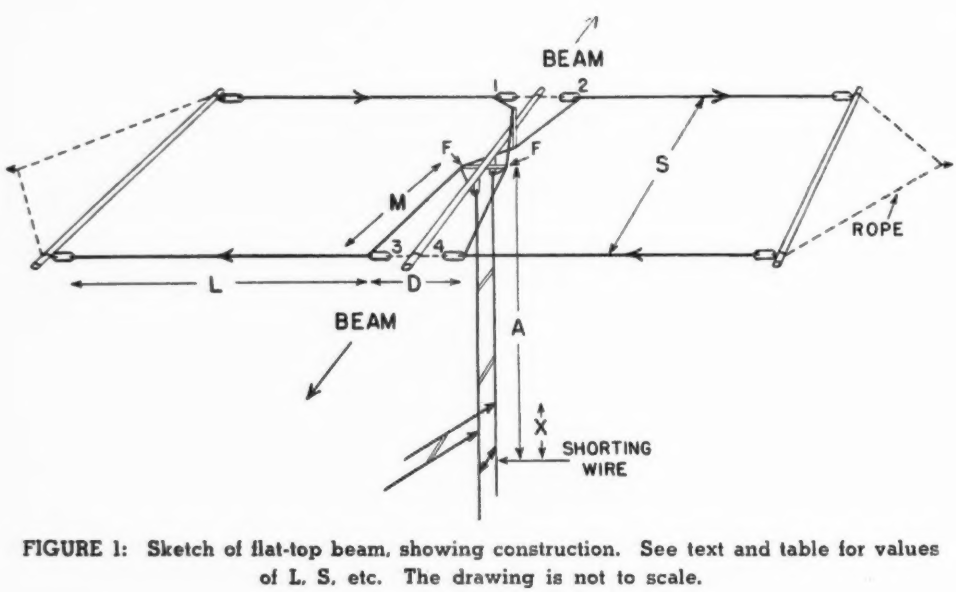


FIGURE 1: Sketch of flat-top beam, showing construction. See text and table for values of L, S, etc. The drawing is not to scale.

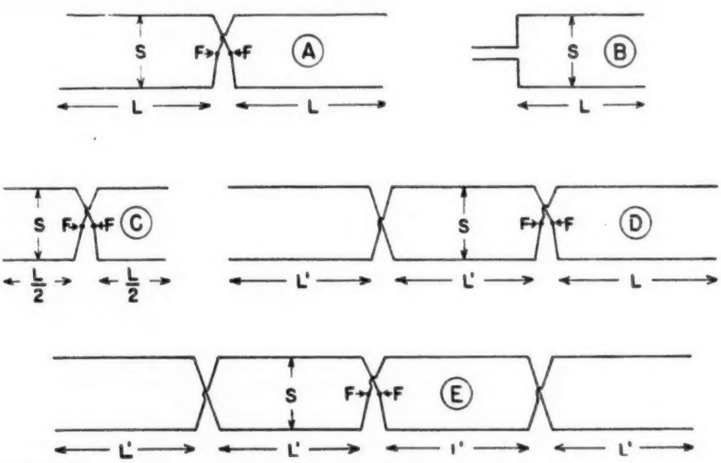


FIGURE 2: Flat-top designs having 1, 2, 3, and 4 sections. L' equals L times 0.85. For L and other dimensions see figure 1 and table below.

one can compensate for it by moving the shorting wire on the stub. Lengthening L would require raising the short, and vice versa. In case Zepp or tuned feeders are used, one can do the retuning at the station end of the line. Thus, the length L can be considerably reduced if it is necessary to squeeze the flat-top into a limited space. The length A is correspondingly increased.

L	M	S	D	A(3/4)	A(1/4)	X
$\frac{429{,}000}{f}$	$\frac{63{,}000}{f}$	$\frac{123{,}000}{f}$	$\frac{28{,}000}{f}$	$\frac{675{,}000}{f}$	$\frac{185{,}000}{f}$	$\frac{28{,}000}{f}$
Example of flat-top cut for 14,200 KC.						
30' 2"	4' 5"	8' 8"	2'	47' 6"	13'	24"

In the above table, all dimensions for a flat-top beam are given, f being the frequency in kc. at which it is desired to operate the antenna. The corresponding values of A for quarter and three-quarter wavelength stubs are also included, as well as the distance X for the point of connection of a 600 ohm line above the short. The values for A and X are only approximate, since with small variations in spacing, height, and wire size in various antennas, each must be tuned up individually. Since each antenna must be tuned up, the other dimensions (L, S, D, and M) are not critical and these lengths need not be made exactly as given in the table. It may be well to add about 5 per cent to the value for A in cutting the stubs to be certain of having them long enough. The lengths A and X are given in the table merely as a convenience so that one may know in advance their approximate magnitude. One can use 6 inch spreaders in the stub and number 12 (B. & S. gauge) wire in the flat-top, stub, and transmission line.

The flat-top beam of the type given in the table has an overall length (2L+D) of about 63 feet when cut for 14 Mc. This is probably the optimum length. In case it is desirable to shorten the flat-top to get it in a limited space, the length of L can be reduced as much as 20 per cent. All the rest of the dimensions remain the same except that for A, which is correspondingly increased. If space permits, the longer lengths are perhaps preferable, although the difference in gain would be very small. The beam from the shortened types (50 feet long overall on 14 Mc.) probably would be a bit broader horizontally than for the longer types. The total length from the end of the flat-top wire to the short on the stub, (L+M+A) is almost a constant. In the case of antennas cut for 14 Mc. using one-eighth wavelength spacing this length is about 82 feet. In case one uses a number of frequencies in an amateur band, it is perhaps best to cut and adjust for the middle frequency. An antenna cut and adjusted for 14,200 kc., for example, will work well over the entire 14 Mc. amateur band.

All of the flat-top beam antennas so far discussed are of the two-section variety as in figure 1. This type may be presented more simply as in figure 2A. The arrangement at figure 2B is a single section, end fed. The dimension L may, as a maximum, be as much as given in the table for L, but it can be made

much shorter. This antenna can be used conveniently either vertically or horizontally. The radiation is, of course, maximum in the plane of the wires and at right angles to them. This antenna is somewhat similar to the "Simple Signal Squisher" described by W. W. Smith in the April (1937) RADIO. The antenna of figure 2C is also a one-section type, being a half-wavelength long, but it is current or low-impedance fed at F, F instead of being voltage fed. The flat-top antenna of figure 2D has been lengthened to a three section arrangement. The overall length on 14 Mc. is less than 100 feet. It may be fed at F, F. The flat-top wires on the single section side of the feed point are made of length L. On the two-section side, however, the length should be L', which is less than L by about half the spacing between the antennas or M; in other words, about 15 per cent less. The antenna of figure 2D could also be current fed at the middle of the center section in the same manner as the antenna at figure 2C. For the four section arrangement in figure 2E each wire is of lengtn L'. This is done to make the current nodes occur approximately at the cross-over points. A single 6 inch feeder spreader should be sufficient to space the wires at these cross-overs. The three-section beam has about 8 decibels and the four section about 10 decibels gain over a single half-wave antenna. The dimension X, given in the table for a 600 ohm line connecting to the stub on a two-section flat-top, will be somewhat larger with the three and four-section arrays.

At the spreaders in the flat-top where the cross-overs are made, the table indicates a suggested value for the distance D between the half-wave section (see figure 1). A fairly large value of D, as given, is helpful in reducing losses as the voltages at this part of the antenna are high. This construction permits a minimum of insulators and harness at the middle. For 14 Mc. flat-tops the eighth wavelength spacing corresponds to almost 9 feet, and the large end of bamboo fish-poles having about a one inch diameter make excellent, strong, light spreaders.

Instead of using eighth wave-length spacing as has been shown in the types discussed, much less spacing is possible. One-sixteenth wavelength spacing was tried and appears to be workable, although the currents in the flat-top wires become quite large. Brown[2] gives data on antennas using only .05 wavelength spacing, which is even somewhat less than one-sixteenth.

Stacking of horizontal antennas affords the possibility of increased gain without added horizontal directivity as pointed out by Conklin[3]. Figure 3A shows a pair of two-section flat-tops stacked in this manner. The dimensions for this array are quite attractive on 10 meters (30 feet overall) and the array could be readily

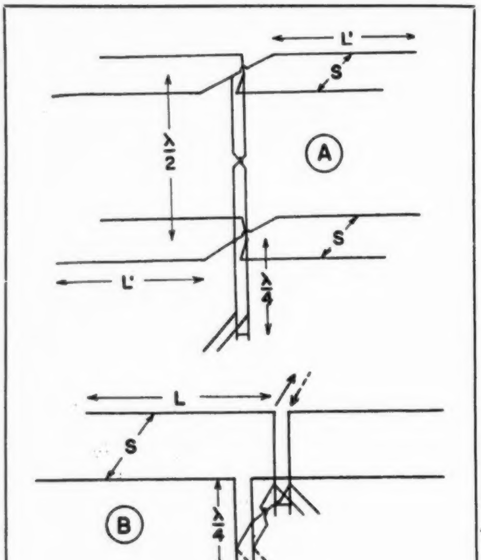


FIGURE 3: Method of stacking flat-tops (A) and arrangement for uni-directional flat-top (B). For L see table on page 11. L' equals L x 0.85.

made rotatable. The gain would be substantial, about 10 decibels or a ten-fold gain in power.

Uni-directional Types

According to Brown[2], two antennas with one-eighth wavelength spacing and with currents 135° out of phase have a uni-directional characteristic. Thus, a flat-top beam with the usual eighth wave spacing but with 135° instead of 180° phasing would be uni- instead of bi-directional. The gain in the favored direction with the uni-directional array would be, however, no more than the gain in either direction with the bi-directional array (180° phasing). The chief advantage of a unidirectional array would be to discriminate on reception against signals from the back direction. Unfortunately, it is not as simple to obtain 135° as it is 180° phasing between the antenna elements. Figure

[2] G. H. Brown, "Directional Antennas," *Proceedings I. R. E.* Jan. 1937. p. 95.

[3] E. H. Conklin, "Antenna Gain without Horizontal Directivity," RADIO, May 1937, p. 52.

3B shows an arrangement which was tried to obtain this phasing. Each pair of half-wave antennas is tuned by a stub, and an eighth wavelength line with a half-turn connects the two stubs. An untuned transmission line can be connected to either stub. When connected as shown in figure 3B the antenna sends a maximum signal in the direction of the solid arrow, and when the line is in the dotted position the beam is reversed as shown by the dotted arrow. Other variations in phasing can be obtained by connecting the feed line at points part way across the eighth wave length cross-over line. Or the cross-over line may be omitted entirely and the free pair of antennas excited parasitically. The front-to-back signal ratio which can be obtained with this combination is, however, not as good.

Both of these types of antennas have been tried and field strength measurements made to check their performance. For transmitting they offer little advantage. On reception the more or less unidirectional characteristic may be of advantage. However, the antennas of this type with the two stubs are rather clumsy and difficult to adjust. They would be attractive mainly to one interested in antenna experimentation. It is necessary for correct adjustment to connect the transmission line and cross-over line so that there are no standing waves on either. This is easier said than done.

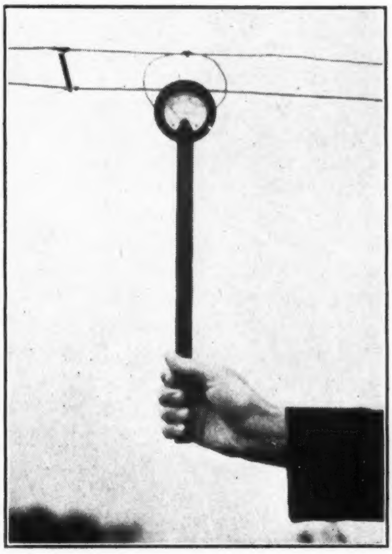
Feed Systems

The flat-top beams of figures 1 and 2 can all very conveniently be driven by tuned or Zepp type feeders. This is a very handy arrangement, as all the antenna tuning adjustments can be made at the transmitter. Tuned lines up to a couple of wavelengths long have negligible losses.

A common method of feeding antennas is by use of a 400 to 600 ohm untuned or matched-impedance transmission line. This requires the use of a one-quarter or a three-quarter wavelength matching stub connected to the flat-top. The extra half wavelength in the three-quarter wavelength matching stub makes no difference in its operation. Approximate dimensions for these stubs at various frequencies can be obtained from the table. A three-quarter wavelength stub will in many installations permit one to pull the antenna up into place and yet to make adjustments from the ground in matching to an untuned line. Also if the shorting wire on the stub is close to the ground, a jumper may be run from the short to the grounding rod after the tuning-up is completed. This affords continuous lightning protection, while the r.f. operation of the antenna is not affected. If the stub and line are properly balanced, no difference in operation should be noted with or without the ground connection.

In tuning up a flat-top with matching stub the shorting wire is first adjusted so that the antenna plus stub are in resonance at the transmitter frequency. A r.f. thermogalvanometer in the shorting wire (figure 4) is used as an indicator while the array is shock-excited. The transmission line is then hooked on and its point of connection above the short is adjusted for minimum standing waves on the transmission line. The procedure given by Hawkins[4] is excellent.

A convenient method of exciting the antenna



Pickup loop and r.f. milliameter for measuring relative current on transmission line.

and stub for adjusting the short is to clip the matched impedance transmission line on a feeder spreader a considerable distance, perhaps a tenth wavelength, above where the short is expected to come. The clips should make no *metallic* contact to the stub, merely *capacitive* coupling. The shorting wire is adjusted for maximum reading on the meter. During this work, the transmitter power should, of course, be reduced as there is no antenna load. A heater coil resistance or a lamp bulb in the plate trans-

[4] J. N. A. Hawkins, "The Matched Impedance 'J' Antenna System," RADIO. April, 1937, p. 40.

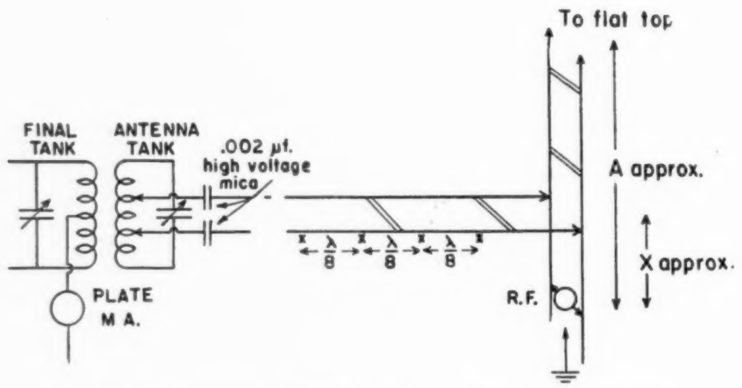


FIGURE 4: Coupling and transmission line connections.

former primary to the final amplifier is a convenient way of doing this. If the transmitter is on low enough power so that the tubes are in no danger and if the feeder system is completely isolated from the transmitter power supply voltages, the transmitter may be left on continuously with regular plate voltage for these adjustments. Heavy gloves to prevent r.f. burns are, however, appropriate. In all cases it is important that the antenna system be completely free from power supply voltages. Either inductive coupling or high voltage fixed condensers in the feed line or both can be used to do this. Both of these methods are shown in figure 4. The coupling system at the transmitter shown in figure 4 works well on push-pull stages. The two coils, final and antenna, are placed in the same relative positions as in the diagram. A spacing of about one inch between the outside of the coils generally gives sufficient coupling. Other methods as given by Dawley[5] are very good.

Checking for standing waves on a transmission line after each adjustment of its point of connection to the stub is quite time consuming. A somewhat more rapid procedure is as follows: With the transmitter on low power the transmission line is disconnected from the antenna coil (figure 4) and the antenna tank is completely detuned. The final tank condenser is then tuned for a minimum of plate current and left in that position. The antenna condenser is then rotated until the plate current of the final stage reads a maximum and this condenser is then also left fixed. The transmission line is next reconnected to the antenna tank and the distance X, at which the transmission line connects to the stub (figure 4) adjusted until the meter in the shorting wire reads a maximum. If the same meter is used for this as for locating the resonance position, it may be necessary to shunt its terminals for this part of the tuning-up process. When adjusting X, the maximum as read on the meter is broader than the resonance maximum and is a bit harder to locate.

When the transmission line has been connected at the point which apparently gives the maximum current on the meter in the short (which also corresponds to maximum current anywhere else in the antenna), one can then check back to see if any standing waves are present on the transmission line. If the meter is of the 0-100 or 0-200 ma. r.f. type, it may be removed from the short and equipped with a pick-up loop as shown in the photograph. This loop, made of insulated wire (no. 18 push-back in this case) has a hook at the top so that it may be easily hooked on the transmission line at various places to check for standing waves.

If, after the above adjustments, standing waves are present on the line, the distance X may be slightly readjusted. Unless the position of the shorting wire for resonance was obtained correctly in the first step of the tuning-up process, it will not be possible to remove completely the standing waves from the transmission line with any adjustment of the distance X. If the short was properly located, however, and if the above procedure to determine X is

[5]R. L. Dawley, "Reducing Harmonic Radiation," RADIO, April 1937, p. 18.

followed, the adjustment will generally be found to be very good and it will not be necessary to make more than a single or final check for standing waves on the transmission line.

In case no antenna tank is used and the line connects through fixed condensers directly to the final tank coil, the procedure is the same. The line is disconnected from the coil, the condenser tuned for minimum plate current, the line reconnected and X adjusted for a maximum of current at the short.

A well matched transmission line may have less than 10 per cent standing waves; that is, the maximum and minimum currents measured along the line may differ by less than 10 per cent. This is not always easy to obtain and much larger standing waves can be tolerated with almost negligible loss in efficiency.

If a meter and loop arrangement, as shown in the photograph, is used to measure the transmission line current, it is important that it be held in the same position relative to the line at each point where the current is measured. That is, if the meter and loop is always held vertically and if one side of the line sags more at some places than at others, the loop will be at varying distances from the line wires and a difference in readings will be obtained which does not indicate true standing waves. It is sufficient to make the readings on one side of the line only, *provided the line is balanced.*

With the meter and loop arrangement in the photograph, readings may be made very rapidly and may be taken at 4 or 5 positions separated by one-eighth wavelength (about three paces on 14 Mc.). This is indicated in figure 4. Sterba and Feldman[6] give a very complete treatment of transmission lines and their adjustment.

Changes in frequency from the frequency for which the stub was adjusted may introduce standing waves on the transmission line, but these will be small for any frequency change within an amateur band.

The position of the transmission line clips on the antenna or final tank coil during the tuning-up of the stub should be symmetrical a turn or two each side of the center. After the antenna and stub have been tuned up, these clips may then be readjusted for proper loading of the transmitter. The coupling between the final and the antenna coil may also be adjusted to do this.

The impedance at the center of a flat-top beam such as the one in figure 1 at the points F, F where the feeders or stub connect is very high, probably on the order of several thousand ohms. Also a large reactive component is present unless the flat-top wires are cut to a particular length. Either Zepp feeders or a properly adjusted matching stub automatically take care of this reactance. It does not, however, make the use of a Q-matching section appear practical for this type of antenna.

With the close spacing (one-eighth wavelength) of the wires in the flat-top, small changes in spacing result in a noticeable change in the tuning. Using a flat-top beam on a windy day when the antenna is being bounced around, one can often detect slight fluctuations in the loading of the final amplifier of the transmitter. These are of little importance in a crystal-controlled transmitter, but might be undesirable in the case of a simple self-excited rig.

A height of at least one-half wavelength above ground seems advisable. A height of three-quarters wavelength is very good. More than three-quarters wavelength elevation would

FIGURE 5: Approximate coverage of a two-section flat-top at W8JK. The antenna runs N.W. and S.E.

give marked improvement only where the antenna would be brought out into the clear by this change.

In a flat-top beam antenna arranged as in figure 1, it is clear that regardless of height above ground, the vertical radiation is very slight, since the currents in the front and back flat-top wires are 180° out of phase. It is not equally as apparent, however, why there is actually a gain horizontally broadside to the an-

[6] E. J. Sterba and C. B. Feldman, "Transmission Lines for Short-wave Radio Systems," *Proc. I. R. E.*, July 1932, p. 1163.

tenna. If the front and back wires were spaced one-half wavelength as is customary in end-fire beam antennas, instead of one-eighth wavelength, one would expect a gain. With the one-eighth wavelength spacing the resultant field broadside to the antenna would appear, however, to be less than for a single antenna unless one considers the mutual effect of the front and back antennas. Due to the close spacing, the currents in the front and back wires are much larger than the current in a single wire for the same power input, so that the resulting field horizontally broadside to the flat-top is actually larger than that from a single antenna. The gain is obtained through a reduction of very high (above 40°) angle radiation, which ordinarily is of little value at 7 Mc. and higher frequencies.

The coverage of a two-section flat-top beam, oriented as at W8JK, is indicated roughly in figure 5. The beam as shown by the shaded portion is fairly broad. It does not begin to drop off markedly until one reaches angles which fall outside the shaded area. The coverage (horizontal directivity) is much similar to that from the common double-Zepp type of antenna. The map is a great circle map centered on Washington, D.C., and the coverage is only approximate since straight lines on this map are true great circles only when they pass through Washington. Since Ann Arbor, Michigan, was taken as the "center" there are inaccuracies of several degrees in some directions. The use of such a great circle map is, however, a great convenience, and this convenience more than makes up for the slight error present. It is apparent from the coverage of one flat-top beam, that three of them would give excellent coverage over almost 360°.

On operation at the fundamental frequency of the flat-top the maximum radiation is broadside in both directions. When operated on its harmonics the radiation will have a number of lobes in the horizontal plane, all of the lobes making angles of less than 90° with the same antenna. If Zepp feeders are used, a flat-top beam can be conveniently operated on a number of bands. By tilting the flat-top some vertical directivity steering may be obtained.

Considering its small dimensions, the flat-top beam is a most effective type of antenna.

The writer is much indebted to Mr. R. M. Whitmer, of the Physics Department at the University of Michigan, for his counsel and assistance.

More 56 Mc. Dx

In response to a request for verification of European advices of five meter reports of W2JCY, we received the following from Laurence M. Cockaday, Editor of *Radio News*:

G5BY was heard at 9:30 and 10:05 a.m. and G6DH at 8:30 a.m. on February 28. G5BY was heard three times previous to this over a period of several months.

W2JCY uses 58.15 Mc. (changed to 58.2464 Mc. on May 1, 1937) with a 1/4 kw. transmitter. This outfit was heard in England on May 9, 1936—a year ago—with a word for word confirmation. Since then five stations have reported these five meter signals and on a regular test schedule Cecil Mellanby of Pwllheli, North Wales, British Isles, has heard W2JCY fairly regularly since last September at the time of month just preceding, during, and directly following full moon. The latest report was from a listener in Whitley Bay, England, who heard a special test schedule with G5BY. This listener had reported W2JCY several times previous to that, using only a two-tube transceiver as receiver.

Regular test transmissions are scheduled weekly on Saturdays at 10:30 a.m. and 11:30 p.m. Eastern time; and Sundays at 1:00 and 9:15 a.m. These are 15 minute transmissions, each followed by a 15 minute listening period, especially for G5BY and G6DH. Heard cards have been received from practically all states east of the Mississippi, from St. Louis, Canada, Florida, Mexico and South America. Stations have been worked on 56 Mc. in the W1, 2, 3, 4, 8 and 9th districts.

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Fadeouts and Solar Eruptions

To assist in correlating the recently noticed radio fadeouts with solar eruptions and explosions, Dr. R. S. Richardson of the Mount Wilson Observatory has been taking accurately timed motion pictures of the sun. The results of this research have been very interesting. Out of fifteen of the recorded eruptions, in five cases the time when the eruption was first seen agreed within a minute or less of the time when the radio fadeout began. In six other cases the eruption apparently preceded the fadeout by from two to twelve minutes.

This comparatively new application of the motion picture camera has greatly assisted the study of solar phenomena.

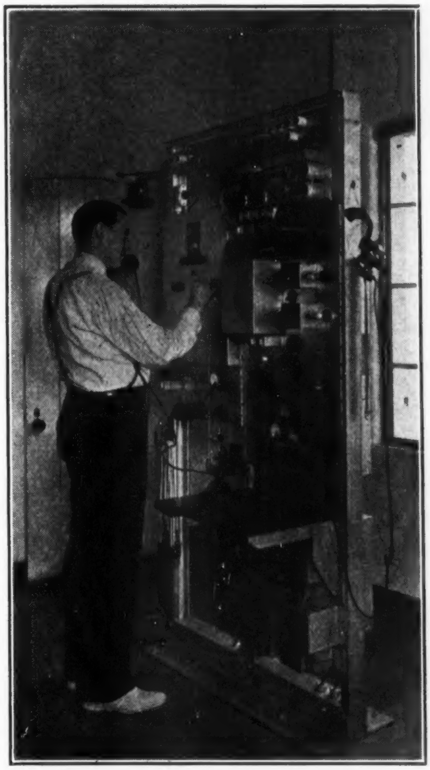
Telephones at Sea

For the past five years telephone service has been available to the larger ocean liners and to some extent the smaller sea craft, such as fishing boats, yachts, etc. With the thought of making this service more flexible and available to all types of boats, the Southern California Telephone Co. a few years back installed "KOU" to cover this service. At that time there were very few boats equipped with the necessary equipment to utilize the service and during the depression KOU was closed down because of lack of activity. However, it has recently reopened and is now running on a 24-hour schedule.

KOU is located on a cliff overlooking the Pacific, with the famed Catalina islands directly off shore giving a view that is hard to forget. The exact location is about three miles north of San Pedro. The rig is located in the tiny Spanish "cottage" seen in one of the accompanying illustrations.

The rig has an output of about 400 watts. The receiver is automatic in that no speaker is used to monitor the signals. When a boat calls in, the receiver automatically sets the transmitter in operation in 30 seconds. Then the operator proceeds with the QSO. The boat jobs are mostly 25 watts input, and are run from convertors off of the ship's lighting plant.

The only license necessary for operating the boat equipment, provided it is under 50 watts, is a Radio Telephone 3d Class.



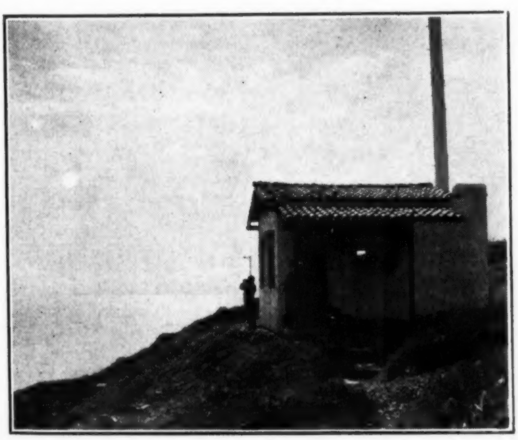
Radio Receiver and Voice Operated Equipment at KOU

When the boat owner wishes to place a call he turns on his rig, calls KOU, and inside 30 seconds receives an answer. The QSO starts in the regular duplex manner, the boats transmitting on 2174 kc. and KOU on 2566 kc.

The phone company charges $3.00 for the first three minutes, and 60 cents for each additional minute thereafter, for all phone calls in the Los Angeles area, while such things as weather reports, transmission checks, etc. are not charged for.

Due to the sudden interest shown there are now about 150 local boats equipped for this service, and many hams have found this new field a profitable and adventurous occupation. On the larger yachts positions are open for those holding second or first class tickets. About 50% of the local equipment is commercially built, while the other 50% has been built by amateurs.

[*Continued on Page 23*]



KOU, San Pedro, Calif. Regular telephone service is rendered all manner of boats up to as far as 1000 miles at sea.

Let's Look at Linears (Part II)

By Ray L. Dawley,* W6DHG

In Radio for May there was given a brief summary of the advantages to be obtained through the use of the class B linear amplifier for amateur phone work. To bear out further the fact that linears are very economical for the power range of from 100 to 300 watts, the practical example to be described was built and checked.

The results obtained were very satisfactory. Using a pair of Eimac 150T's, 250TL's or 250TH's in a conventional circuit, 200 watts actual output was obtained at 2000 volts with the tubes running below maximum rating. With the plate voltage increased to 2500 and then 3000 volts, 250 watts of carrier power was obtained with the tubes running at maximum plate dissipation. The tubes were biased to the theoretical cut-off point in each case (plate voltage divided by amplification factor). There seemed to be no point in increasing the plate voltage above 2500 volts as far as economical output was concerned. However, at the higher plate voltage the excitation power required was reduced slightly by the fact that less swamping resistor dissipation was needed to obtain linearity.

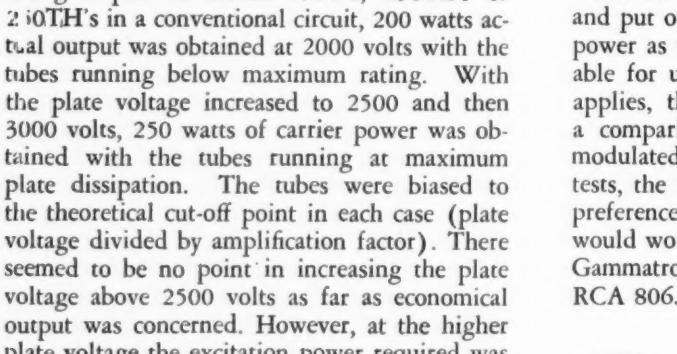
A similar advantage was gained through the use of the "low" (medium) μ 150T or 250TL tubes in place of the higher μ 250TH's. One reason is obvious: the grid *current* excursions will necessarily be higher with high μ tubes. This means that a lower value (ohms) and higher wattage swamping resistor will have to be used to insure linearity in the grid circuit of the high μ tubes.

Another reason for using low μ tubes is that the low μ tubes almost always have a better dynamic grid characteristic.. So we see that while the higher μ tubes will work satisfactorily and put out approximately the same amount of power as the lower μ ones, they are less desirable for use as a linear. The same reasoning applies, though to a more limited extent, to a comparison of the two tubes as grid bias modulated amplifiers. So, for these particular tests, the 150T and 250TL tubes were used in preference to the 250TH. Other tubes that would work well are the Taylor T200 and 814, Gammatron 354C, Amperex HF200, and the RCA 806.

Forced Draft

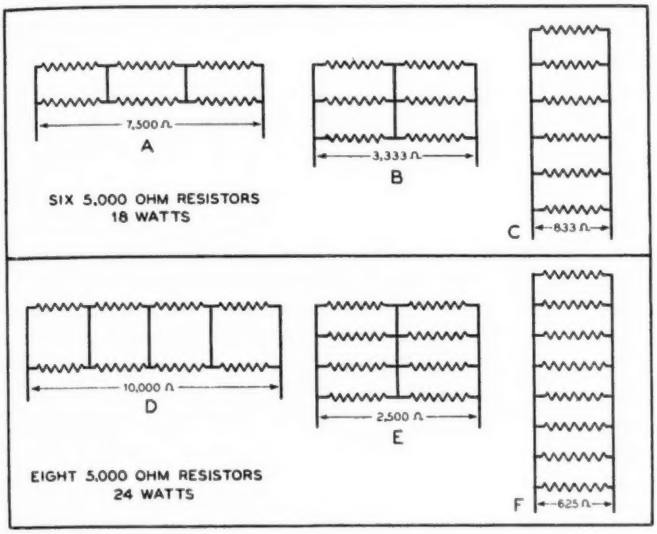
With conventional tubes operating at normal ratings as a class C amplifier the limiting factors to the power output are primarily the peak filament emission and the peak plate voltage that the tubes will stand. For class B linear operation, however, the limiting factor is (as was mentioned in the previous article) primarily the plate dissipation allowable on the tubes. Now there are many things that limit the allowable plate dissipation: the temperature at which the plate may be operated before it will release occluded gas, the maximum temperature at which the glass bulb may be operated before it tends to release occluded gas or to soften, to name the more important ones. Obviously we cannot exert any control over the first two of the factors. However in the last few years a great many forward strides have been made to minimize the limitations imposed by these first two. So we see that if we keep the glass temperature down below the maximum safe value we can utilize a great deal more of the tubes' useful characteristic.

*Technical Editor, Radio



A 10-20 Meter Linear. For Lower Frequencies, Increase C_1 and C_5.

C_1—75 μμfd. per section, 3000 volt spacing
C_2—.005 μfd. mica, 1000 volt
C_3,C_4—"800 Type" neutralizing condensers
C_5—50 μμfd. per section, 6000 volt spacing
C_6,C_7—.002 μfd., 5000 volt
R—Swamping resistor, see text
RFC_1 — 2½ mh., 125 ma. choke
RFC_2 — Optional 500 ma. choke, see text



This method of glass cooling is quite simple and involves nothing more than the proper placing of an inexpensive 8" fan. A brief further discussion of the principles involved was given on p. 41 of RADIO for May. At any rate the fan should be placed so that its stream plays directly upon the envelopes of both tubes. The resultant blank cooling will allow the normal plate dissipation rating *without* forced draft to be exceeded by 25-60%, providing one of the other factors (mentioned before) does not come into play. Also the life of the tube at the normal rating can be somewhat prolonged by this cooling.

The Modulated Amplifier

The modulated amplifier that precedes the linear stage can, of course, be modulated in any of the conventional ways. Grid, suppressor, or plate modulation may be used. Also the linear stage may follow another linear or a single sideband amplifier as the case may be. In any case the peak output or the carrier output (peak output in a single sideband stage and carrier output in a constant carrier system as is more commonly used), whichever is considered, should be roughly one tenth that to be expected from the linear.

Since a linear amplifier may be adjusted to have a *slight* modulation-gaining characteristic with a negligible increase in distortion by *slightly* overbiasing it, they are well suited to follow a modulated amplifier that is not capable of modulating quite 100% without distortion. Both grid and suppressor modulated amplifiers fall into this class. They are easily capable of modulating 90% with very little distortion. Thus we may adjust our linear so that when the preceeding stage is modulating a maximum of 90%, the linear is modulating the carrier 100%. In this way the overall distortion of the system is reduced.

Mechanical Construction

The particular linear shown and described herein was built primarily to illustrate the principles described in the previous article. Consequently it was built upon a wooden baseboard and is not necessarily meant for exact reproduction. Much attention, however, was given to obtain short leads and a balanced circuit layout. The layout itself, therefore, does lend itself well as a suggestion when using similar-type double-ended tubes.

The plate tank (both coil and condenser) is mounted upon a small flat piece supported by a vertical upright. This upright is of such a length as to bring the plate tank to the approximate level of the plate connections of the tubes. Then the neutralizing condensers are mounted vertically upon this upright. In this way we have short plate leads, short plate tank to neutralizing condenser leads, and quite short leads from these condensers to the grids of the tubes. Aside from this the layout is perfectly conventional.

Tuning Up

Without a doubt the first thing to do when tuning up a linear is to forget it entirely and concentrate all your efforts upon the modulated amplifier. If this stage is not operating properly and stably with good linearity and no bugs or parasitics, it is a hopeless task to try to get a linear to work. So we see that we must first get the modulated amplifier so adjusted that it will operate perfectly and modulate 100% with ease. Then the plate current which gives proper operation of the modulated stage should be noted, as this value will be needed later. Then we can leave this stage and turn our efforts to the linear.

The first thing to do is to neutralize accurately the linear stage. It is quite important that it neutralize to the proverbial "gnat's eyebrow". If there is any trace of r.f. that cannot be eliminated from the tank circuit, in other words, if there is any reaction between the input and output circuits, it will be nigh impossible

to keep the amplifier from oscillating when it is standing with cutoff bias and full plate voltage. If accurate neutralization cannot be obtained, the amplifier had best be laid out in first one fashion and then another until it does neutralize properly. In many cases an amplifier which will operate perfectly as a c.w. amplifier will fall down miserably when it is tried as a linear.

The next test is to set the linear up with full plate voltage and slightly less than cut-off grid bias. If it will stand there while the plate condenser is tuned some distance each side of resonance without breaking into some kind of oscillation on its first try, it is truly a remarkable amplifier. In most cases there will be some one or more kind of oscillation take place: either a low frequency as determined by the r.f. chokes in the circuit, a high frequency determined by lead length and stray capacities, or a frequency near the carrier frequency and caused by regeneration in the amplifier.

In the amplifier shown there was no trouble experienced from neutralization difficulties or high frequency parasitics. The stage did, however, oscillate quite strongly at some frequency below 500 k.c. as determined by the r.f. chokes. At cut-off bias with about 2500 volts on their plates, the tubes drew about 450 ma. and put out great flames of this low frequency r.f. Tuning of either the plate or grid condensers had little or no effect on the parasitic. The trouble was quite definitely and very effectively cured by removing the plate choke RFC_2. However, it was still shown in the diagram because it may be needed in some cases if a slightly different layout is used. In any case it is a poor idea to use chokes with similar characteristics in both the plate and grid circuits.

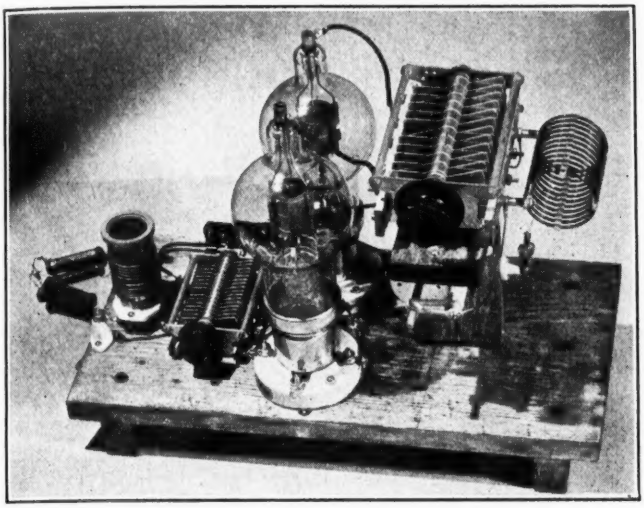
High frequency parasitics can be eliminated by a different layout, or, if they persist, can be stopped by the use of small parasitic chokes. The carrier frequency oscillations can in most cases be stopped by proper neutralization and layout. One thing that will greatly reduce the tendency toward any kind of parasitic and also help the general operation of the linear amplifier is to use quite a large value of split-stator grid tuning condenser. The capacity from grid to ground on each side of the tuning condenser (this, of course, is twice the total tank capacity) acts as a very effective by-pass to any other than the carrier frequency.

Now, if all the parasitics have been eliminated with the amplifier standing without any excitation, the next test is to apply the excitation (without the swamping resistor across the tank) and vary it (by means of the coupling link or any other convenient method) from zero to the maximum amount available. This maximum value of excitation will of course be considerably more than ever used under operating conditions. The amplifier should be loaded up to the antenna or a dummy for this test. It should be possible to vary the excitation between these wide limits without any parasitics or irregularities taking place. If it is possible, the amplifier is then ready for operation as a linear.

Now comes the grid loading operation, which is accredited the most difficult part of tuning up a linear. The swamping resistor should be non-inductive and capable of dissipating about 60% of the input to the modulated stage. This modulated stage should, as mentioned before, have a carrier power output of about 10% of the output to be expected from the linear. A single 801 with 35 watts input was used to excite the linear stage in the laboratory tests.

A convenient way of making the swamping resistor is to take a number of three watt 5000 ohm carbon resistors and series-parallel them in such a manner that the load is equally divided between them. There are in most cases (with six or eight resistors in all) three to six different resultant resistances that can be obtained while still dividing the load equally between them. A few of the possible combinations that would be of the order of resistance required by an ordinary type linear are shown in the diagram. Tubes similar to those mentioned before will ordinarily require a value of from 2500 to 5000 ohms directly from grid to grid. Lower μ tubes require a somewhat higher resistance and higher μ tubes a lower value. The arrangement used in this particular linear is that shown at B of this figure and the resistors were connected from grid to grid on the two tubes.

The proper procedure is to try first the resistors connected directly to the grids in this manner. Apply cut-off bias to the linear, normal plate voltage to the modulated amplifier, and turn off the plate supply to the final stage. Then increase the coupling between the modulated stage and the grids of the linear until normal plate current (as was noted before) is obtained on the modulated amplifier. The grid current should be of the order of 3



In a majority of cases the first try will not be satisfactory. Here are a few difficulties that may be encountered and their remedies.*

Amplifier modulates down—Reduce excitation by lowering resistance of swamping resistor and increase coupling to antenna.

Amplifier modulates up but less than 100%—Same as above.

Modulates properly but tubes run too hot—Decrease antenna coupling and excitation.

Tubes run too cool, not enough outhot—Decrease antenna coupling and excitation.

Amplifier modulates more than preceding stage—Increase excitation, vary antenna coupling if necessary, reduce bias slightly.

to 10 ma. If it isn't, try a different value of swamping resistor; if too low, a higher value; if too high, try a lower value. If a satisfactory point cannot be found in this way, try a value of resistor that was too low from grid to grid and tap it down the coil a small distance.*

After a satisfactory point has been found, apply the plate voltage to the linear and couple up the dummy antenna until the stage draws an input of about 1½ times the total plate dissipation in the stage (750 watts input for this particular linear).

Now we need an audio oscillator (such as that described in RADIO for Nov., 1936), a buzzer in front of the microphone, or some other source of constant tone as an input to the speech amplifier. Place a thermo-galvanometer, oscilloscope, or other modulation indicating device on the output of the modulated stage and find the point to which the gain control must be advanced to obtain 100% modulation of this stage. Now place the indicating device on the output of the linear and run the gain control back and forth between zero and the pre-determined point of 100% modulation of the exciting stage. If the modulation follows up with no irregularities or flattening-off points and the tubes do not operate too hot under no modulation, the adjustments that have been made are satisfactory. However, the possibility that the first adjustment will be satisfactory in all respects is rather remote.

*It is preferable, when possible, to use a slightly higher value of resistance and connect directly from grid to grid. This provides a better regulating effect and also has a very beneficial effect upon parasitic oscillations.

If the preceding steps were taken properly and in the order given, no difficulties other than those given should be encountered. The actual adjustment is really much more simple than these many lengthy paragraphs would indicate and each adjustment made has a very definite bearing on the emitted signal.

When the final adjustment has been made and the quality sounds "broadcast", remove the dummy, connect the antenna and adjust it until the linear draws the same plate current as with the dummy. She is now all set to go.

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The lowest note anyone can whistle, says Cal Hadlock, W1CTW, is 500 cycles. If you need a thousand-cycle note for test purposes, whistle your lowest possible note, and then, according to Hadlock, you need only to hit an octave higher and presto, there is your test signal. You will be surprised at the accuracy of this crude method.

*The whole procedure will be more simple if one will realize that the maximum amount of excitation that can be used while preserving 95-100% modulation capability is dependent upon antenna loading. The heavier the loading, the more excitation can be used. If the loading is too light or the excitation too heavy, the stage cannot be fully modulated. The simplest method is to increase the excitation in easy jumps and increase the loading each time just enough to preserve "100% modulation capability"; when the tubes are drawing 1.5 times their rated plate dissipation in plate input, stop.

In actual practice no attempt is made to get full 100% modulation capability. "100%" means in the vicinity of 95% modulation. Above 95% modulation, the distortion rises very fast in any transmitter, regardless of the type modulation used. Few broadcast stations attempt to modulate over 95% on peaks for this reason.

Common Troubles With Common Power Supplies

If you are using the same power supply to feed both your class B modulator and final amplifier, it is highly important that you decouple the two with a choke and condenser. If this is not done, the second harmonic distortion will be excessive, greatly impairing the quality of your signals.

There are quite a large number of amateurs using class B modulation who are operating their final amplifier from the same plate supply that supplies the modulators. If proper precautions are not taken in the design of this power supply, it is very difficult to obtain high-percentage modulation of the final stage without the introduction of a bad second harmonic *audio* component. The inferior audio quality of a

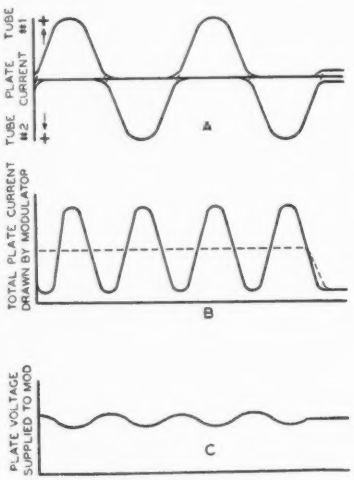

Figure 1

number of the class B modulated amateur phones can be directly traced to this condition.

This is caused by the fact that there is a very strong second harmonic component in the plate current drawn by the modulator tubes. The diagram shown above illustrates graphically the reason for the existence of this component. Figure 1A shows the plate current flow for *each* tube of the two tube modulator as it would look from the two halves of the primary winding. Figure 1B, however, shows the combined plate current flow through the center-tap of the output transformer to the power supply for the same two cycles as were plotted in 1A. The dotted line through the center of the plot indicates the plate current flow as it would be integrated by the ordinary plate circuit milliammeter. The presence of this line also clearly shows the four cycles of second-harmonic energy flowing in the plate return of the modulator.

Figure 1C indicates the supply voltage variations caused by the appearance of this second-harmonic variation in plate current across the filter condenser that by-passes this return to the power supply. This would be condenser C_1 in the power supply shown in figure 2. The amount of this variation is determined by the regulation of the power supply, the frequency that is being passed, and upon the size of C_1.

To look at it from another angle, we see that during the half-cycle of conduction for each tube in the modulator the a. c. component of plate current flow (which of course is what we desire at the output) travels from the plate of the tube through one half of the primary winding and is by-passed to ground by this condenser C_1. Hence, by this latter reasoning we see that this condenser should be as large as is practicable. If you wish to prove to yourself the veracity of the statement above, insert a choke between the modulator power supply and the lead that goes to the center-tap of the class B output transformer. If the stage is running truly class B, the output will fall to almost nothing and you will be unable to "talk up" the plate current on the tubes. If the stage is running AB, the output will fall off less, and if the stage is class A, it will not be affected.

So we see that by both lines of reasoning the condenser C_1 should be made quite large. The actual value, of course, is not critical and will vary widely with different modulator systems and with the requirements placed upon them. For an example, with a pair of -03A's operating at 1250 volts under normal conditions, a 10 or 12 μfd. 1500 volt condenser would be satisfactory. This is for a minimum modulator resistance (as presented to the power supply) of the plate voltage (1250) divided by the maximum plate current (0.350 amperes) or about 3570 ohms. A higher-

resistance modulator (higher plate voltage, lower maximum plate current) would require a proportionately smaller value of condenser. A lower resistance affair would of course require a larger value.

The values of condenser given above would be capable of by-passing lower audio frequencies than would be required in amateur work, but since this condenser does assist greatly in handling *syllabic* variations in power supply drain in addition to its regular filtering duties, the use of a large condenser at this point does tend to stabilize greatly the rig for voice work. Another and last point in this connection, a 10 or 12 μfd. condenser, really costs but little more than a 4 μfd. condenser of the same make and voltage rating. The cost seems to vary roughly as the square root of the capacity.

Now to consider briefly the balance of the power supply: The rectifiers should of course be mercury vapor. The input choke should be

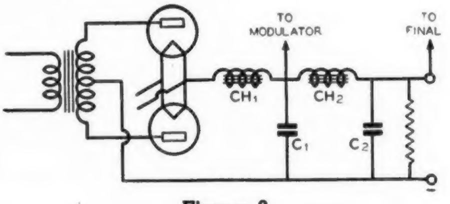

Figure 2

a large one, preferably of the swinging variety, and capable of carrying the full plate current of the final stage and modulator. The power transformer should also be capable of handling this maximum plate current. The second choke, CH_2, is used to attenuate further any second harmonic variations appearing across C_1 and to provide the additional hum filtering required by the final amplifier. The condenser C_2 serves a similar purpose to the final amplifier as C_1 does to the modulator. It serves as a by-pass between the bottom end of the modulation transformer secondary and ground in addition to its filtering action. Consequently it should also be quite high in capacity. About half the capacity used at C_1 will be found ample for most cases.

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The *oscillaphone,* alias Massie telephone, was a popular detector in the early 1900's. It consisted of a needle resting lightly between two carbon electrodes. Rectification was by means of imperfect contact.

Telephones At Sea

[*Continued from Page 17*]

To date the following shore stations are now in operation, and there are many more under construction, which will give many hams the first crack at building the boat equipment for this work: San Francisco, KLH; Seattle, KOW; and Boston, WOU.

Boats have been worked as far as three thousand miles where a call was placed to Los Angeles. Incidentally, this is one time the boat owner really came out ahead. Think of the charge had he placed the call from land! (The price of $3.00 is maintained no matter where the ship is located.)

While we were visiting KOU the other night, a boat placed a call from the coast of Washington, a distance of over 1500 miles. The usual maximum daytime range is 1000 miles while at night, as noted above, most anything may happen.

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When Not to Bloop

To keep amateur radio from getting a black eye, we suggest that you do not try to copy the signals of planes attempting transoceanic flights with a radiating blooper unless you live at least 100 miles or more from any population center or department of commerce or airways station. An r.f. stage ahead of the "blooper" regenerative detector will cut down the radiation from the receiver, but will not entirely eliminate it, and the receiver may still cause interference to receivers a few blocks away when receiving weak signals.

The c.w. signals of a plane on a recent trans-Atlantic flight were obliterated during part of the flight by several radiating receivers. It was not possible to copy the signals when they dropped below R6 because of the many "birdies" on the frequency.

An Associated Press dispatch stated that "amateur radio men were trying to pick up Merrill's plane, making it increasingly difficult for the air line to receive the plane's signals."

That sort of thing does amateur radio no good.

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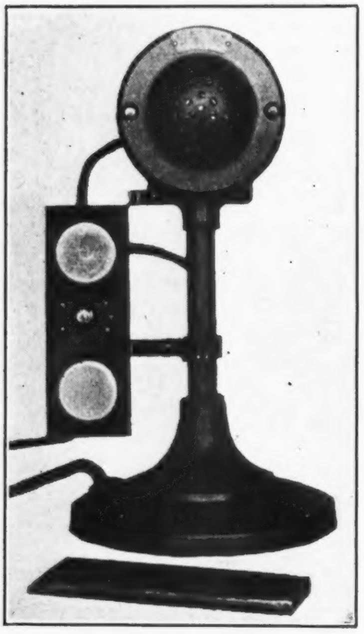
Also Abused by Commercials

I am the center of gravity,
Holding the chief situation in Vienna,
Always out of tune, yet ever in voice,
Though plainly seen in the midst of river.
It is in vain you seek me,
For I was long embalmed in the grave,
But now I am in Heaven.

(*Juvenile Riddle*)

High Sensitivity Dynamic Microphones

By Robert S. Kruse



The High Level Dynamic Microphone with Outboard Amplifier

The well-deserved popularity of the diaphragm type of crystal microphone among radiophone amateurs is certainly due to its high sensitivity and comparative ruggedness. Any microphone which can equal it in these regards is of amateur interest, especially if it has no objectionable features as do the carbon types.

The moving-coil or "dynamic" microphone was at one time in the class of "high quality but low sensitivity", along with the ribbon and the condenser microphone, which require 1 or 2 stages of pre-amplification to bring them up to the level of the ordinary 2-button carbon type. Recent work on the "dynamic" microphone has produced the new high sensitivity type which, I believe, was first offered by the Radio Receptor Company, whose type 7B was used in obtaining the information in this paper. However, a number of other manufacturers are now offering a similar product.

Output Level

The sensitivity, being of prime amateur interest, was first compared with other microphones of standard make with the following result:

Microphone	*Output level (average for 600, 1600 and 3200 cycles)*
(High Sensitivity Group)	
2 button carbon	—45 db
7B Dynamic (moving coil)	—50 db
Diaphragm-crystal	—54 db
(Low Sensitivity Group)	
Non-diaphragm crystal ("sound cell")	—66 db
Ribbon ("velocity")	—66 db
High Fidelity Dynamic	—85 db
Condenser	—70 to —94 db

Other models would change the figures somewhat, but dynamics of the 7B class clearly belong in the very desirable (for amateur communication) high-output group, and are quite free of the ailments of carbon microphones.

Fidelity

When comparing microphones which are all well suited for speech transmission, there is not much good in showing frequency-response curves obtained in the usual point-by-point way by many hours of weary work with steady tones. In the first place the differences between the curves of good mikes will be less than the differences commonly imposed by the room or the amplifier. In the second place, these curves may fail to show short-time effects quite capable of doing speech-damage readily detected by attentive listening. No such objectionable effects were heard from the new dynamic.

Ruggedness

All modern microphones except the carbon type survive bumps well but differ in sensitivity to vibrations arriving from the desk via the mike stand. Attempts to measure this bad sort of sensitivity gave results that differed widely with the type of vibration. They did not favor any one microphone in all cases.

Hum Pickup

Hum pickup (usually from the stray field of the plate supply transformer of the amplifier itself) is perhaps the most common disorder of amateur speech systems. It is naturally most serious at the amplifier input because the hum is then amplified by all stages of the amplifier. A crystal microphone here has the advantage of being able to work into the first grid with no coupling device other than a resistor. This leaves no chance of hum pickup ahead of the first tube except that of the grid lead and micro-

phone cable, both easily controlled by shielding. However, this shielding must also protect the tube from r.f. pickup to which the grid is exposed by the high grid resistance necessary with a crystal mike.

All other than crystal microphones require a step-up transformer ahead of this first grid for maximum output, but there is no reason for permitting the transformer to pick up hum. To show how this may be prevented, the measurements of figure 2 were made on a 4-stage class A amplifier of 100 db gain which had practically no hum output except as hum was intentionally introduced at the microphone transformer. Even under the worst conditions of figure 2 the hum output dropped to less than 1/20th of 1% of the possible audio output whenever the microphone transformer was shorted on either the primary or secondary side.

As a better check the microphone transformer was replaced by a resistor equal to the transformer's secondary impedance at hum frequency, whereupon the hum output fell even lower and could not even be seen on a 5" cathode ray screen at maximum sensitivity. Therefore, figure 2 represents only the hum due

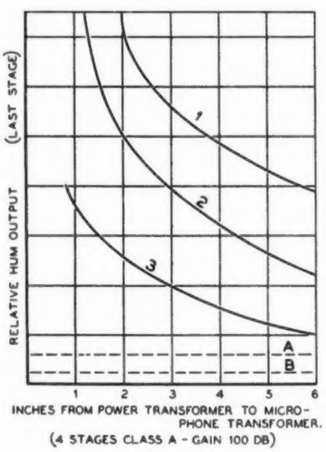


Figure 2

to the microphone transformer. Curve no. 1 was obtained with an unmounted mike transformer, curve no. 2 with a similar one in a pressed steel case and curve no. 3 with a recent type having a thick cast casing of high permeability. Even no. 3 produced a hum well above the dashed line "A" representing the hum level which can be noticed with a good loud speaker during normal speech pauses. It was desired to get down to "B", the hum just observable during silent periods. In other words "B" is satisfactory for good public address work while "A" will serve for amateur voice modulation because the so-called "communication type" receivers mostly use small speakers reproducing low notes deficiently. This, plus the tolerance of the receiving operator, commonly causes level "A" to be reported as o.k.

In our example the power transformer had fairly strong stray fields for its size but as the a.c. power input was only 128 watts the conditions were average, agreeing with earlier measurements on other equipment. The transformer, incidentally, was allegedly shielded by a flat steel baffle 1/16" thick, whose removal made the usual difference—none.

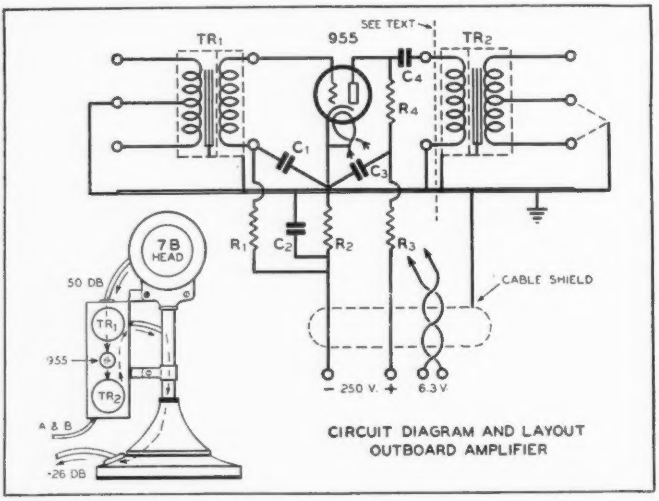
Flat baffles near the low level tubes are sometimes helpful but even the limited information of figure 2 makes clear the extreme ease of reducing hum pickup by simply using distance, which costs nothing, weighs nothing and is not hard to cut or drill. This means simply moving the first amplifier stage bodily out of the chassis and using it several feet away as a separate small amplifier, incidentally stopping any ordinary regenerative instability. Even the "B" level of hum reduction is then easily reached. At the same time the separate amplifier is not as touchy as the familiar "pre-amplifier" used with low sensitivity microphones because we are starting at a level from 15 to 50 db higher. It pleases me, therefore, to say we are using an "outboard" amplifier which also describes the mounting used.

How Much Outboard Amplification?

For the amplification required in amateur stations there is no hum pickup problem after the speech has been elevated somewhat above the level of the 2-button carbon microphone. This means that our hum is well eliminated if we keep the speech away from the main amplifier and its hum factory until we have amplified the speech up to -35 db, which is 10 db above our carbon mike. Likewise it is only about 15 db above a microphone like the 7B; hence any general purpose triode will do, but added protection against hum is obtained with higher outboard gain, permitting still lower gain in the main amplifier.

The Outboard Amplifier

The 955 acorn triode was used because of its high mutual conductance and μ. The small size of the tube permits housing the entire amplifier, including two miniature transformers in a light steel box 1¾" wide, 4⅜" high, and



CIRCUIT DIAGRAM AND LAYOUT OUTBOARD AMPLIFIER

C_1—0.25 µfd. 400 volt tubular
C_2—0.25 µfd. 400 volt tubular
C_3—0.25 µfd. 400 volt tubular
C_4—0.1 µfd. 400 volt tubular
R_1—250,000 ohms, ½ watt
R_2—8,000 ohms, ½ watt
R_3—20,000 ohms, ½ watt
R_4—100,000 ohms, ½ watt
TR_1—Miniature shielded line to grid transformer
TR_2—Same, plate to line transformer

2½" deep mounted on the desk stand itself as shown in the photograph, figure 1. This simplifies wiring and affords a location clear of a.c. equipment without cluttering the table.

The circuit diagram and layout appear in figure 3 while the photograph shows the amplifier with the front cover removed. Only the parts protruding forward through the sub-panel can be seen, of course. At the top is TR_1, a miniature microphone-to-tube transformer. At the bottom is the tube-to-line transformer, TR_2. This small output transformer cannot tolerate plate current; hence the 100,000 ohm shunt feed resistor and 1/10 microfarad stopping condenser. At first the 955 produced considerable hum when heated with a.c. This was eliminated by using the "through-the-panel" tube mounting, grounding the filament and cathode as shown in figure 3, enclosing the filament leads in a grounded copper tube inside the amplifier, and concentrating all grounds at one point within ½" of the 955 cathode. In addition the sheath of the output cable was grounded at this point and also at its other end to the main amplifier. Thereafter hum was absent even with the output cable lying full length along the A and B supply cable. This in itself gives a hint of the advantage gained. The stage-gain of the outboard amplifier is just under 24 db, bringing the output level up to -26 db, one stage above carbon mike level. The main amplifier now has an easy job and its gain may be reduced, leaving as the final result improved stability as well as a large reduction, practically an elimination of hum. The main amplifier input is, of course, provided with a line-to-grid transformer or a 2-button-mike-to-grid transformer, connected by a shielded pair or trio to the secondary of TR_2, both transformers being similarly grounded preferably at the center tap.

If cost must be reduced, a 6C5 tube may be used in place of the 955 and the front cover omitted or provided with a 1¼" dia. hole. For distances up to 6 feet it is even possible to cut off the diagram at the dotted line, omitting TR_2 and feeding through the 1/10 microfarad condenser directly into the cable supplying the main amplifier. This cable is then of the type used on crystal microphones and the main amplifier input transformer is then of the inter-stage sort, preferably shielded, and certainly raised, lowered, and test-rotated to locate the humless position. This position is very easy to find.

So much for dynamic microphones under adverse conditions. On the other hand, if your amplifier is a good one, innocent of all hum and instability when used with a carbon mike of the 2-button type, and if it has ample gain for that job, your case becomes very simple. No outboard amplifier whatever is then needed for a dynamic of the 7B class. In fact it is sometimes satisfactory to leave even the input transformer unchanged, merely feeding into one-half of the primary winding. Nothing could be simpler than that.

◆

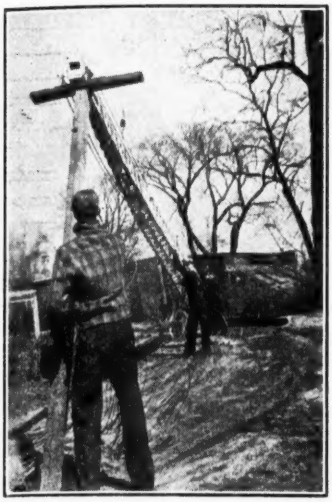
Many phone amateurs have noticed the difference between the "liveness" of European recordings and records made in the U.S.A. If you have never noticed this, compare one of "recorded in England" Victor records (such as Jack Hilton's "Just a Gigolo") with a domestic recording of the same number. The reason for this is that they use a longer reverberation time, about 0.7 second as compared to about 0.3 second for this country.

◆

Henry Scott, world's fastest pianist, has played 268 notes in six seconds. We observe that at that rate the thumps of his finger tips on the keys could produce a 44-cycle tone.

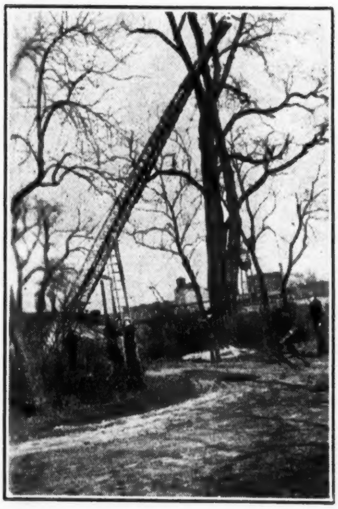
"RADIO" GOES TO A POLE RAISING BEE

Photos by J. Jozwik, Jr.



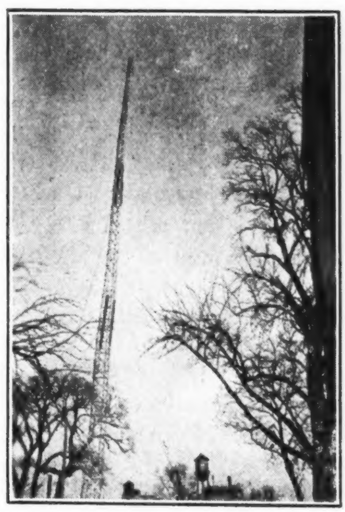
1 Whew, finished at last. I wonder if she will buckle.

2 Six helpers; six ideas as to how it should be put up.



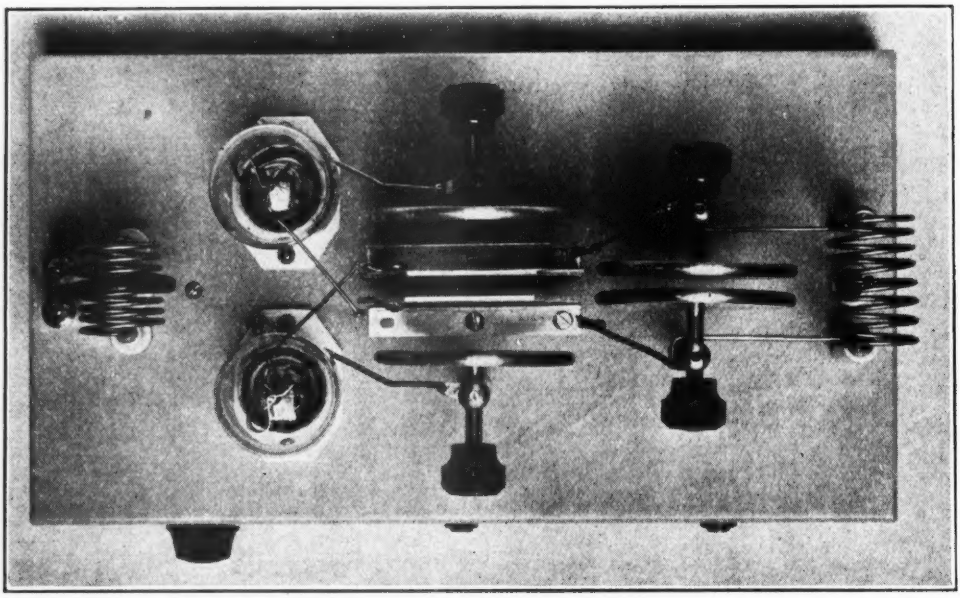
3 Steady! Don't tangle those top guys and we are all set.

4 Easy! Don't pull; just keep her straight. Hey, STEADY!



5 Aaahhh. There she is, 91 feet. Who has the plumb bob?

A "Specialized" 5 or 10 Meter Amplifier



Looking straight down on the "Specialized" u.h.f. amplifier. The two circular plates to the right are for tuning, those to the left for neutralizing. The recangular plates (fixed) provide lumped capacity

A 250 watt amplifier with a tank condenser large enough for 160 meter phone operation *can* be made to work on 10 meters by putting in a suitable tank coil. But the large amount of metal in the circuit and many linear inches of condenser plate "edge" will reduce the efficiency of the amplifier on those frequencies, even if the minimum capacity of the condenser is low enough to allow a proper L/C ratio on 10 meters (which it probably won't be).

The obvious remedy is to use a tank condenser with the same voltage rating but less plates (smaller physically). The trouble is then that one will not be able to get sufficient "Q" on the low frequency bands, especially for phone.

The root of the difficulty is that from 160 meters to 10 or 5 meters is just too big a jump. What we really need is a separate amplifier stage for the higher frequency bands. We can make the big condenser work okeh down to 20 without appreciable loss; so what we need is a separate amplifier for use on 10 meters.

This is desirable for another reason: Our plug in coil arrangement is satisfactory for the lower frequency bands, but on 10 meters the leads to the coil chucks form an appreciable part of the tank inductance. With a separate 10 meter amplifier we can use an air wound self-supported wire coil and bolt the coil right to the condenser, or at least reduce the lead length appreciably if the coil is mounted on stand-off insulators.

The best bet of all would be to use the high "Q" linear rod amplifier described in the January issue by Ray L. Dawley.

The only objection that can be raised to the separate amplifier system is the matter of cost. However, this can be kept down to a surprisingly low value.

We will assume for the sake of economy that the tubes are switched back and forth from the final amplifier of the main transmitter to the outboard 10 meter amplifier. After all, it is no more of a chore than changing the final plate coil, which is no longer necessary with the separate 10 meter stage.

Now all we have left are a tank condenser and coil, a grid tank condenser and coil, and miscellaneous small items (resistor, r.f. chokes,

etc.). The coils can be wound up from a few feet of number 12 copper wire, which is very inexpensive. The grid condenser will be a midget, which does not cost much as condensers go. The only items left are the plate tank condenser and neutralizing condensers. If we can dispose of these in an inexpensive manner the argument for the outboard 10 meter amplifier will be cinched.

In the first place, because the tank condenser requires so little capacity, one can be purchased very reasonably. And neutralizing condensers can be easily made from a few scraps of aluminum if low capacity tubes are used. In fact, the tank condenser itself can be home made if desired. A couple of pieces of brass or aluminum about 3 or 4 inches square can be mounted with a quarter inch air gap and the affair tuned by bending one plate in and out. This will not be a "split stator" affair, but with a push pull stage a split stator plate tank condenser is not necessary or even advisable, provided the stage is laid out symmetrically, a good r.f. choke is used to feed the plate tank coil, *and a split stator grid condenser is used.* Grounding the rotor of the grid tank condenser will establish a balance to ground that will not be upset except by clipping onto the plate tank with a single wire fed antenna, etc. As this is not advisable with a push pull amplifier anyhow, it is of no particular disadvantage.

In the photograph is shown a 10 meter amplifier with a unique plate tank and neutralizing assembly. This assembly was made up from two of the new Bud u.h.f. split stator condensers. Each of these condensers consists of a center stationary plate, mounted on a stand-off insulator, and two movable plates that move in and out by means of a screw thread on each side of the stationary plate. By taking two of these condensers and swapping the various parts around a bit in a way in which the manufacturer never intended (or rather never expected), we have a very inexpensive and efficient tank tuning and neutralizing assembly.

The method of assembling the condenser parts can easily be figured out from inspection of the illustration. However, before assembling, it is a good idea to round off the edges of the two stationary plates by scraping with a razor blade (used as a sort of "draw knife"). The edges of these plates were not rounded as are those of the movable plates.

For tubes such as the 35T, where the plate lead comes out the top of the envelope, it is desirable to make contact to the two stationary plates at their tops in order to obtain shortest plate leads. This can be done by using countersunk flat-head screws (to preserve the uniform air-gap between the two stationary plates) and mounting the screws close as possible to the corner edge of each plate. Then by sliding the outside movable (neutralizing) plates forward a quarter of an inch or so from where they would ordinarily be mounted with respect to the stationary plates, the screws will not be in the way of the "neutralizing flippers." This is not nearly so complicated as it sounds, and would be obvious to anyone arranging the various parts for mounting.

Tuning is accomplished by the two movable plates in parallel with the two stationary "lumped capacity" plates. Tuning is not so convenient as with a conventional condenser, but inasmuch as the rig is tuned up on 10 meters and left alone, this is a minor objection, especially in view of the many things the arrangement has to recommend it (short lead length, economy, etc.)

Because of the method of mounting, the plates should be mounted on a *heavy* chassis to eliminate any chance for wobble. Many of the chassis commonly sold in the smaller sizes will not be heavy enough for rigidity.

The grid tuning condenser, mounted below deck, has its rotor grounded. Both grid and plate coil are fed through r.f. chokes and are not bypassed.

Some slight body-capacity effect will be noticed when tuning the amplifier, due to the fact that the movable plates are "hot." However, after one becomes used to it this will not be found objectionable, as it is only necessary to "allow" a bit when adjusting the capacity. If the stage were being retuned all the time, this would be more of a problem. Amateurs who have at some time or other used a single-section condenser to tune a split coil will already be familiar with hand-capacity effects and how to tune "slightly past resonance" before drawing their hands away.

A safety precaution if over 1000 volts is used on the amplifier is to remove the small knobs on the *tuning* plates (the neutralizing plates can be readjusted as needed for neutralization with the plate voltage *off*) and replace them with better-insulated knobs. The set screws on the knobs supplied with the condensers may "bite" at very high voltage.

The type construction shown is also highly recommended for 5 meter operation.

DX

By HERB. BECKER, W6QD

Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, California.

G2ZQ WAZ

Johnny Hunter, G2ZQ, is the second in the world to accomplish the feat of working *ALL* zones. Johnny's 40th zone was AC4YN in Tibet, and you can bet that G2ZQ got a big thrill in hooking up with him. Before going any further, here is the complete info about AC4YN. 2ZQ worked him on April 21st. The station is operated by ex-VU2DR, Mr. Fox, and ex-G5YN, Mr. Nepean, of the British Political Mission, Lhaha, via Gyan-tse, Tibet. In fact that is the whole QRA. Now the important part for you fellows: the frequency of AC4YN is 14,180 kc. with a T7-T8 note. Go get him! Johnny hooked him just after G6WY signed off with him, and the funny part of it is G2ZQ had been off the air for five weeks due to his y.l. being home from college . . . . she had gone back to school just the day before! That immediately raises the question, "Is Johnny glad college didn't start a week later or isn't he?" I think I hear those wedding bells getting tuned up over there for them. Here are stations in each of the 40 zones that he has worked.

1. K7UA, K7FCR	21. YI6KR
2. VE5NO	22. VS7GJ
3. VE5EH	23. AC4YN
4. W5FRR	24. MX2B
5. W1AVV	25. J8CA
6. XE1AG	26. HS1PJ
7. K5AA	27. KA1LY
8. HH5PA	28. VS1AA
9. PZ1PA	29. VK6FO
10. OA4AL	30. VK7CH
11. ZP6AB	31. K6COG
12. CE7AA	32. ZL4AO
13. CX1CG	33. CN8MI
14. CT2AA	34. SU1EC
15. ZB1F	35. ZD2A
16. U5FK	36. ZD8A
17. U9AV	37. ET8FA
18. U9AC	38. ZS3D
19. U0LC	39. FR8VX
20. ZC1S	40. TF3TP

Incidentally, for the gang's information the method of QSLing used by G2ZQ is as follows . . . . . To all stations outside of Europe except W, VE, VK, ZL, ZS, PY, LU he QSL's immediately, and those stations such as W, VE, VK, etc., he QSLs the minute he receives their card. All of the above is nice going . . . . . . and congratulations, Johnny

G6WY hooked up with AC4YN just a little while before 2ZQ, and after a QSO on c.w. he put his phone through to Tibet. Van Whyte has been spending considerable time on phone lately and seems to be doing all right with it. He says it's "shocking" to work such dx code hounds as W6GRX and W6GRL on 20 meter phone, and the queer part of it is, GRL thinks the same about G6WY. Among other two-way phone QSO's for him are VK3IW, VK2ADV, VK3GQ, VK7CL, VK3KX, VK5AI, LU7AC, LU1QA, LU4AW, PY2CK, YV5ABE, VU2CQ, VS6AH, SU1KG, CN8AF, FT4AA, CO8YB and many W's in all districts. That surely covers all continents. G6WY did a nice job when he worked ZL4BR on 3.5 Mc. during the contest on c.w. Van Whyte says that G5KH worked AC4UU on 28 Mc. a very short time ago . . . . . So there is another one for you guys to go after. No frequency available yet on him, though . . . . . . G5QY has worked FY8C in New Guinea, and VP8B in Falkland Islands.

How Many Countries Have You?

There's that question again. Allright, you asked for it . . . . . and here it is. Beginning with the July issue of RADIO . . . . . which is the next issue . . . . . this department will print your country totals

G8AC, Sussex, England

along with the number of your zones. To qualify for countries you must first have 28 zones and the number of countries will be printed in another column right next to your zone total. So . . . . to all of you fellows that have your call and zones listed in the WAZ Honor Roll at the present time, you have another job on your hands . . . . . Just sit down and figure out how many countries you have as per the "official" country list in the January issue of RADIO.

Sweden

From SM6UJ I learn that he has been a very sick man, but is getting around a bit now. O.m. Ahner says that many of the SM dx hams are using good receivers . . . . . You see, in their country they are not prohibited from buying radio "gear" abroad. SM6UJ has had an HRO for several months and says it is surely swell . . . . . and then adds that with a good antenna and a good receiver a guy doesn't need much of a transmitter, hi. That grand old man

of ham radio in Sweden, SM6UA, has a Super-Pro and is still active on the air . . . . . Just a month ago he celebrated his 71st birthday.

Another Country Heard From

Around the first of May, my friends W6LYM and W6BAM worked F58AA, on the island of Uea, which is supposed to be northeast of Fiji. No, that isn't a typographical error . . . . . the call is F58AA . . . . . T8 . . . . 14,429 kc. and he comes in usually between 0400 and 0630 G.m.t. Norol, W6LYM, lives in Orange, Calif., and has a fine QRA, to say nothing of his swell rig using a pair of 250TH's . . . . . two VEE beams with about 450 odd feet in each leg . . . . . . whoa.

Canada

VE5HC pops out with this: "What do the fellows know about TZ2A on 14,490 kc., T7?" I think he's really got something there, dunno what, but might be something . . . . 'way out there in the "commercial dx band." Sez to him sounded like a phony South American. Ditto for me, too. VE5HC nominates G2PL and F8EO as the most consistent European stations in VE5, and reports also, that VE5LD in Zone 2 is on Sundays on 14,020 kc. around 1900 G.m.t., and U0LD on 7200 kc. from 1400 to 1600 G.m.t. 5HC says that on a recent visit to W7BB's shack he found things in a sad state . . . . . rig was rather decomposed and covered with cob-webs.

France

Our ol' pal, F8EO, shoots in some good information. In the recent dx contest the most active F hams were 3KH, 8ZF, 8LX, 8TQ, 8JI, 8RR and 8EO. F8EB and F8FC seem to be content to rest on their laurels of former years, and as for F8EX . . . . . he's still on his honeymoon . . . . . hi. FM8AD with his two 210's made 90,000 points in the contest, which is sure darn good for that QRP. F8EO, of course, had about 1050 QSO's in the test and 500 of them were on 10 meters.

Francois says that 8WB, 8EX, 8FC and himself are planning rigs for 56 Mc. work with powers of 50 to 100 watts, using T55's and 800's. 6L6's and 807's are very popular with the boys as exciters. On 10 meters 8EO says the phone of W6JJU is very good but due to bad QRM it is sometimes tough to get even the good ones through. Wants to know when the W's are going to create a 10 meter phone band such as is on 20 meters. For the benefit of the gang overseas, and elsewhere, I might just mention that the phone band on 10 meters for W stations is from 28,000 to 29,000 kc. That means that the whole high frequency end of the band from 29,000 to 30,000 kc. is open to c.w. code stations only. Why not get the gang interested in going down there. If a few of the consistent dx men would move their frequencies into that section of the band, we would soon have things well in hand. How about it . . . . . let's get the c.w. fellows down there. Well, anyway, to go on with F8EO's report . . . . . he had a nice QSO with PZ1PA on 14,380 kc., and says, too, that the Pacific stations come through around 0530 G.m.t. and after that . . . . . about 0630 a few K6's pop in, K6AKP being very good. Francois claims that lately the European stations have been coming in pretty strong, making it bad for good reception of other dx sigs. A common complaint that many of the boys are making over there is that there is too much phone QRM between 14,250 and 14,400 kc. We think so here too, and if the phone stations that are using frequencies between the above mentioned spots, would shift into the recognized phone band . . . . . 14,150 to 14,250 kc . . . . . they would make thousands of hams the world over . . . . . very happy. In ending his report F8EO says that 7 Mc. is sometimes very tough to work because of the Spanish phone stations.

"WAZ" HONOR ROLL

ON4AU	40	W9EF	35	W9IWE	30
G2ZQ	40	ZG1Z	35	W6FKZ	30
G6VP	39	W9KA	34	W6DIO	30
W8BTI	39	W8JK	34	W1APU	30
W7BB	39	W3EMM	34	W3AWH	29
W3SI	39	W3EGO	34	W9LW	29
W6CXW	39	W2FAR	34	W6HJT	29
W4DHZ	39	W9PK	34	W8FJN	29
W8CRA	39	W6LYM	34	VE5HC	29
W6GRL	39	W1AQT	34	W3CDG	29
W6ADP	39	W7BYW	34	W3TR	29
W3PC	39	W6ENV	34	G6ZU	28
W3ANH	39	W6FKC	34	W8DOD	28
G6WY	39	W8AAT	34	ZU1T	28
W9TJ	38	W6FZL	34	W6CGQ	28
G5YH	38	W6TI	34	W6GNZ	28
W6CUH	38	W8CNZ	34	W5EOW	28
W8HWE	38	W9LQ	33	W9JNB	28
W9ALV	38	W3EVW	33	W6HJT	28
VE4RO	37	W3AYS	33	W3EYS	28
W2BSR	37	W6GHU	33	W6CEM	28
W2GW	37	W6DOB	33	W6JBO	28
W8DFH	37	W6LDJ	33	W9VBB	28
W6OD	37	W9LBB	33	W6GK	28
W8BKP	37	W5AFX	33	W3CDG	28
W2GWE	37	W9AFN	33	W6KEV	28
W8OSL	37	G6CL	33	VU2LJ	28
W6FZY	37	W6VB	33	W9DEI	28
G6NJ	37	W6BAM	32	W8HGA	28
W2DTB	37	W8HYC	32	W6LHN	28
LY1J	37	W6KZL	32	W3CZO	28
W8LEC	37	W9CWW	32	W8LZK	28
W6HX	37	W6KIP	32	W6LCA	28
W7AMX	37	W8BTK	32	VK4DO	28
W4AH	37	W5EHM	32	W6LEE	28
W2HHF	37	W9EF	32		
W8KKG	36	VE2EE	32		
G6RB	36	G6GH	32	Phone:	
W9ARL	36	W8OQF	32	W4AH	31
W8KPB	36	W2AAL	31	W2HUQ	27
W1ZB	36	W3DCG	31	W5BDB	27
W1CC	36	W5CUJ	31	VE2EE	26
W9PTC	36	W8DWV	31	W6BGH	26
W6GAL	36	W3CIC	31	W3SI	25
W6AM	36	W8LDR	31	W8JK	24
W9KG	36	W6HXU	31	W3EMM	24
W3EDP	36	W6KRM	31	W6ITH	24
W2OA	36	W6HEW	30	W6OCH	24
W6KBD	36	W2BXA	30	W6NNR	23
W3EXB	35	W8MAH	30	W6AM	23
W6NHC	35	W7AVL	30	VE5OT	23
W6GRX	35	W3UVA	30	W6BAY	23
W8CJJ	35	ON4VU	30	W6LLQ	22
W2AIW	35	W7AYO	30	W6OEH	22
G6QX	35	W9PGS	30	W7AO	22
W6EGH	35	W6KWA	30	W6MLG	22
W2BJ	35	W4MR	30	W9QI	21
W3BBB	35	W8DED	30	W1COJ	20

If you have worked 28 or more zones and are willing to produce confirmation on demand, send in your score on a postcard.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.

Straits Settlements

VS1AA, J. MacIntosh, advises that anyone who worked VS1AA between November 9, 1936 and February 7, 1937, was working a pirate. His station VS1AA was definitely not on during that period. Mac also says in case anyone who has worked him has not received a QSL card to get in touch with their respective QSL bureaus, as he never fails to QSL.

Bahamas

From the office of the Superintendent of Telegraphs at Nassau in the Bahamas we learn that they have been receiving QSL cards addressed to VP7AB. The sad part of it is that VP7AB is apparently an unlicensed station . . . . and their law distinctly rates the working of an unlicensed station as a criminal offense.

Belgium

ON4VU has worked 30 zones and some of the dx that is in his log includes J2LL, J5CC, J8CD, VU2BA, VU2KT, CE3AC, K4BRN, VP2TG, ZE1JU and many others. ON4VU is on the air nearly every day between 0600 and 0800 G.m.t. and on the lookout for dx, especially Pacific Coast stations.

England

Nelly Corry, G2YL . . . . . says that a new station heard around noon by 2BFL in Croydon is AC4UU in Tibet. He was heard telling a W (who is the W??) that G5KH was his first G . . . . and that was on March 24th. The above was on 28 Mc. as is the rest of the info from Miss Corry. G6DH hooked TF5C . . . . . Africans were heard spasmodically and included FA8IH, SU1JT, SU1RO, ZE1JJ, ZE1JU, ZS1C, ZS2N, ZU5B, and FB8AB. That long lost man of Jamaica VP5PZ, John Grinan, is on 10 meter fone and had his first G contact with G6LK on March 18th.

G6QX, Bob Jardine, has been using a T55 on 10 lately and one Sunday afternoon he worked 29 dx stations, finally quitting with a glass arm. After the contest Bob hooked up with K4 and VE5OA for two new zones, and now he has 35.

Saudi Arabia

I am going to quote a portion of a letter received from Bill Aldwell, W6LBM, who is now in Al Khobar, Saudi Arabia. It is quite interesting in that he brings out the difference between Hedjaz and Saudi Arabia . . . . . and too, it clears up the mystery to some extent about OS3BR. Here's part of Bill's letter:

Al Khobar, Saudi Arabia

Sirs:

I note with interest in the DX columns that OS3BR is listed as having given his QRA as near Jeddah, Hedjaz. Allow me to inform you that there is but one station in all Saudi Arabia capable of working on the short waves, and I am quite sure that it has not been using the call OS3BR, as I am the only person operating it, and have never used that call on short wave or long wave, either. The station so designating itself cannot be anything else but a "phoney", much as I regret to say this, on account of the gang who is possibly expecting QSL's.

We hope to be on the air shortly on 40 and 80 meters with about 400 watts on voice and key, and will use the call HZ1AA; shortly afterward, HZ1AB will also be on. Just how soon this will happen, it is hard to tell, as we have to get a few things ironed out with the Government first. At any rate, the call HZ1AA will not be a fake, when and if used.

One thing further: I note in your country list that Saudi Arabia and the Hedjaz are listed as two countries. This is, of course, wrong, as the Hedjaz is merely a province of Saudi Arabia. The call group HZ is listed as belonging to the Hedjaz, but is in reality assigned to all of Saudi Arabia; we, for instance, use the call HZA, although we are in Hasa, on the other side of the country from the Hedjaz. The latter was formerly an independent country, but was annexed by King Ibn Saud, and is now just another province in the kingdom.

I should like to see this error in the countries list corrected, as when we get on the air on the ham bands, we don't like everyone asking "what the heck, etc." . . . requiring more explanation than it is worth.

BILL ALDWELL, HZA, HZ1AA, W6LBM.

I believe this will be of interest to the dx gang, and let's keep an ear open for HZ1AA.

Cannonsburg, U.S.A.

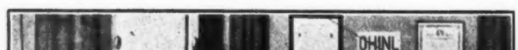
W8CRA came out of his shell long enough to work himself a couple of new ones on 14 Mc. VK4KC is one of them. Hey, don't laugh . . . . . just because it's a VK. This one happens to be in Papua, which is on the same island as New Guinea. The other one for Frank was PK6XH in Netherlands, New Guinea . . . which is on the other end of same island. Incidentally, PK6XH is ex-PA0XH . . . . . remember him? 8CRA has been so busy taking care of his harem that dx has almost taken the count. He'll be back one of these days and when he does, it will be with a vengeance.

Hawaii

K6CGK is responsible for the following: He says that K6AKP worked this AC4YN a short time ago, and he was about 14,200 kc. with a 1000 cycle note. The time of the contact was 1900 G.m.t. I'm convinced that this is no phony; get busy and get this guy while the "gittin" is good. Or . . . make an offer to K6AKP for the card when he gets it. . . . He'll trade it for one from Iceland, hi. Another great deed that AKP did was finally to end this feud with G5YH by actually working him. Remember G5YH claimed that the K6 gang never listened and the K6's claimed the same, with nothing very much being done about it. According to CGK, K6AKP converses nightly on 20 meter fone with the J's, including Scratchi at Osockme, and no foolin' he actually carried on in unadulterated Japanese. As for K6CGK himself . . . rolled up 163,000 points in the contest, 1110 contacts in 50 districts on four bands. He is still using those 8 year old 210's into a diamond beam.

Note to Foreign Stations

To the many foreign stations that are lamenting their inability to hear any stations in Nevada, we offer the following: W6ETJ is on quite regularly on 14,040 kc. Yep; he is in Nevada.



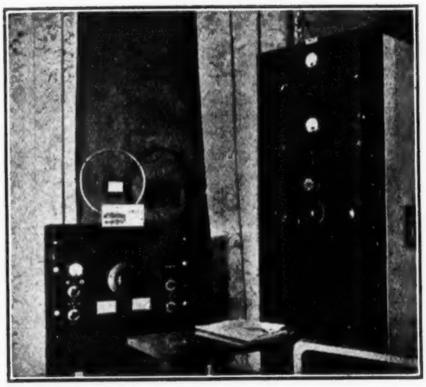
OHINL. Suomi. Finland

Hopping Around U. S. A.

W8LDR running 140 watts input to his T-55 has been knocking over some nice dx, some of which includes U9ML, U9MJ, I1TKM, I1RRA, VQ8AF, SV1KE, LA4K, ES5D, FT4AK, KA1US, KA1MD, YR5CP, YR5AR, YL2CG, SU1SG, SU1CH, J2MH, J2CB, J5CC, LY1J, SM6WL, K7FYI, VU2AU, VS7RF, VK6SA and many others . . . . W6EFC in Arizona has a new job, chief op of KOY; he also

has a new QRA and is already burning up the air. He says he has 20 acres of land which should hold lots of diamond antennae. W6FFC is on fone and he recently worked SM5ZS and says the SM reported him as being "louder than W6CUH" . . . . . My, my, since when was CUH on phone? . . . W9LQ recently purchased a new Collins transmitter with the result that he gets on the air more than before. During the contest he raised his zones to 33 . . . . .

Ed Stevens, W7BB, while tramping around in the Oregon forest ran across that old 40 meter hound, W8SB. W8SB is Lieut. Al Barris, the executive officer at a C.C.C. camp . . . . .W4DIQ in Jacksonville, Florida, running only 50 watts to his 210 has worked HR7WC, FA8DA, CE4AD, ES5D, OZ7SS, YR5CF, CN8MI and on 40 has hooked CN8AN, SV1KI, K7PQ, CN8MN, OE7EJ, SM7UC, FM8AD, VP2LA.



SM6UJ, Askersund, Sweden

W9UWD with his 80 watts on a T-20 worked two J stations at 2 a. m. c.s.t. and wants to know if that isn't somewhat unusual for a W9 . . . . . W8DFH has been on the air a little over a year, and has 37 zones and 100 countries to his credit. Also has worked 50 Asians and 100 African stations. Recently he snagged ZS3F and thinks he is the first ZS3 to get going . . . . frequency 14,385.

W8DFH says that W8HWE and W8CRA are about the only ones going after dx around Pittsburgh these days, and then adds that 8CRA is not on a great deal due to QRM from the YL's. Other stations by W8DFH are VR2FF, 14,100; OX3M, 14,415, J7CJ, 14,400; and ZB1L, 14,230 . . . . . W8HWE, Bob Haas, worked K6OJG in Guam for country number 105. Bob was the first W contact of XU2ZA, who is ex-K6NDH, ex-W2BDU and says to QSL in a plain envelope to Felix L. Ferranto, American Embassy Guard, Peiping, China.

For those who want to send a card to VU7JP the QRA is J. S. Nicholson, Munnar, Travancore, Southern India . . . . W8NYJ of Cleveland was heard in Germany on 80 meter c.w. with 30 watts input to a 210.

Charlie Waff, W3UVA, has a new final with a pair of 100TH's in it and seems to be doing right well. He has 30 zones and 71 countries to his credit. Some of his better dx includes CP1AA, LY1AF, SM6SO, TI2LR, VP2LA, XU8JR, U1AD, FA8CR, ZS1AL, ZS1AN, FA8IH, YR5CF, ZS5U, VP2AT, U9MI and U9AF.

W7AOL worked these new ones . . . . . VQ8AA, ZS1AH, ZU1Q, ZS4U, ZU1T, ZS1AX and ZS1Z. W9CWW is still at it and now has 32 zones . . . . Some of the new stations for him are VS6AG, VS1AF, PK4KO, PK3BM, PK1VH and YL2CG . . . W9GK connects with U1AD, U5AE, U2AE, U9MF, U3FB, L1IR, OH2NB, VP5AD, ON4FQ, F3AM, YR5AA, ZZ2A, G5RI, G2VD, G2CL, LA6U, and a few others . . . . . W9TXG rebuilding and will be on with more soup real soon now . . . . Keat Crockett, W9ALV, has just worked his 38th zone. Incidentally, Keat is the first W9 to get 38 zones.

My friend W6KZL and his x.y.l. are on a trip east. Glen has a portable rig with him using an HF-100 in the final. Glen and his wife are a slick dance team so keep an eye open for "Blaine and Elaine." Right now they are somewhere in Texas. Before they left, KZL made w.a.c. twice in one day.

W9OKW may have the highest powered call but Bill Moran says that he thinks he should get the blue ribbon for the lowest powered call: W2ION. W2ION also wants to know if anyone knows anything about XX2JJ. Neither do I.

Ah, here's another W9, this time W9VOV of Kewaunee, Wisconsin. He says that his section is not as favorable for dx as either coast is, and probably he is right. But VOV built himself one of these 6L6G exciters (one tube) such as was described in December RADIO and this coupled to a half-wave antenna has given him good results. The antenna, which is zepp fed and is about ten feet above his chimney, seems to work ok and he has worked K5, K7, CM8, LA2, PY2, KA1 and many others. VOV goes on to say in his letter . . . . "and why is it that while I am able to contact the Philippines, I repeatedly fail to contact W6 stations? Here I need Idaho, Arizona, Utah, and Nevada for w.a.s., and although I hear those states they don't want to hear me. Many's the night I have gone to bed with a bitter heart (and lots of other W9's along with me . . . . but not in the same bed) cussing the ornery W6's who haven't got the heart, and maybe the receivers, to give a poor W9 a break! Aren't there any real hams in those states?" Gee, that is surely a sad state of affairs when we W6's neglect the W9's. I think we better look into that, pronto.

If all of the W6's would work as many 9's as QD does, there wouldn't be room for complaints . . . . ahem! Which further reminds me that this department is receiving complaints from other districts for not answering their calls. Must be the skip.

W6TI Horace Greer, of Oakland, Calif., worked FT4AG in zone 33 for his 34th zone. Freq., 14,038 kc., T8. W7AO in Toledo, Oregon, has just worked his 22nd zone on 'phone. His rig uses a couple of 300T's in a linear (wonder if it's an Oregon kw.?) and the antenna is one of W8JK's beams, which gives him a 3 point gain in So. Africa over an ordinary type. 7AO also says that W7DNB has just hooked a So. American station for his 'phone WAC.

W2BSR, Art Braaten, did pretty well for himself on April 21st when he worked U9AW, U9AV and U9ML in rapid succession for good solid QSO's. Said he would have given his shirt to have done

[*Continued on Page 86*]

A Low Cost Crystal Mike Amplifier

By Raymond P. Adams*

The Amplifier with its Cushioned Swivel-Mounting Crystal Mike

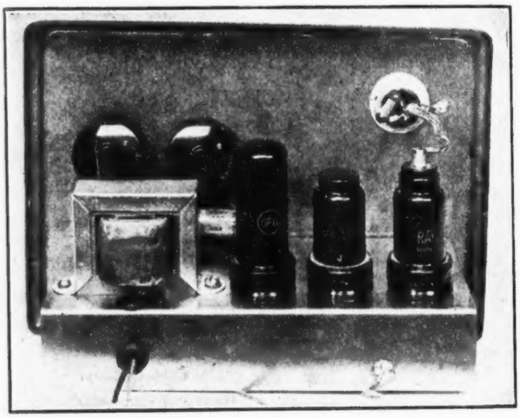
There is a prevailing practice on the part of "kit-form" and built-up amplifier manufacturers of releasing thoroughly complete and single-unit designs of such construction and gain as to permit direct mike connection to the first tube. These may meet with the approval of most public address agencies and perhaps ten per cent of the transmitting amateurs who adapt these amplifiers to modulator service. But there remain a few p.a. men and that other 90% of the amateur phone enthusiasts who find compactness in the audio frequency system more troublesome than convenient and who for a number of good reasons demand separate preamplification and some means of controlling the percentage of modulation and/or amplifier gain from the operation desk.

Consider the amateur alone. As far as he is concerned, a complete amplifier-modulator reposing squarely in front of him on the operating table becomes entirely out of the question. It takes up too much space where space is really needed. The somewhat bulky modern-day receiver and the usual monitor and "freqmeter" and perhaps that new cathode ray modulometer will pretty well occupy all available space on the operating table. If the transmitter is located at a more or less remote point and the thing is a rack and panel job with speech input stages built-in, he'll have his table nice and free—but he'll have to get used to the idea of long cable feed from a lone mike at his elbow and of having no ready means of adjusting a.f. gain.

If the transmitter, similarly complete, is fairly close at hand, he'll still be at a disadvantage, for every time he decides to adjust the gain he'll have to reach up and over or around to get at the right control. All in all and whatever the set-up—the number of units, the completeness of the a.f. section, the proximity of controls which will occasionally need adjustment—he'll eventually decide that a small preamplifier sitting close at hand on his desk and taking up no appreciable room will be a mighty nice thing to have.

But all this isn't news. And neither is the fact that, generally speaking, a good a.c. operated preamplifier involves a whale of a lot of care in design and selection of components.

That all said, we'll get on to the subject at hand—a desk amplifier which works very well and which certainly shouldn't drain very hard on limited pocket power.



Back View of the 4 Watt Amplifier with Cover Removed

Physical and Electrical Design

The complete preamplifier, exclusive of power supply, is mounted on a $3\frac{1}{2}$ by 8 by $1\frac{1}{2}$ inch open-ended chassis installed in a manufactured crackle-finished shield can. The can is but $9\frac{1}{2}$ inches long, $6\frac{1}{2}$ inches high, and $4\frac{3}{4}$ inches deep, and is provided with removable front and rear covers, removable bottom plate, and

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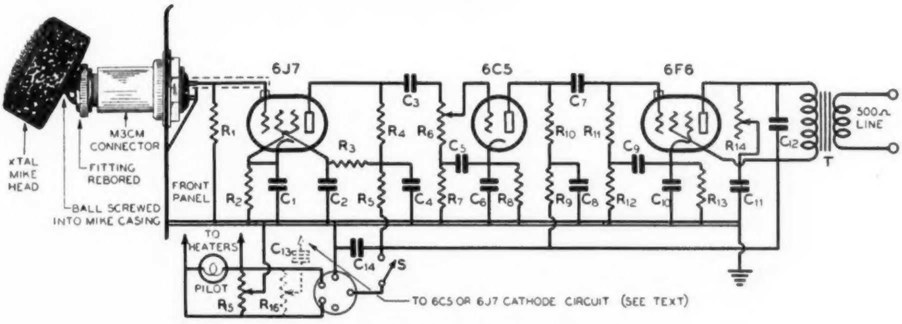


Schematic Wiring Diagram of the Amplifier Proper

C_1—25 µfd. 25 volt elect.
C_2—0.25 µfd. 400 volt tubular
C_3—0.1 µfd. 400 volt tubular
C_4—0.25 µfd. 400 volt tubular
C_5—0.1 µfd. 400 volt tubular
C_6—25 µfd. 25 volt elect.
C_7—0.1 µfd. 400 volt tubular
C_8—.25 µfd. 400 volt tubular
C_9—0.1 µfd. 400 volt tubular
C_{10}—25 µfd. 25 volt elect.
C_{11}—.05 µfd. 400 volt tubular
C_{12}—.006 µfd. 400 volt tubular
C_{13}—0.5 µfd. 400 volt tubular
C_{14}—8 µfd. 450 volt elect.
R_1—5 megohm ½ watt
R_2—2500 ohms, ½ w.
R_3—1 megohm, ½ w.
R_4—100,000 ohms, ½ watt
R_5—100,000 ohms, ½ watt
R_6—500,000 ohm potentiometer
R_7—100,000 ohms, ½ watt
R_8—2500 ohms, ½ w.
R_9—10,000 ohms, ½ watt
R_{10}—50,000 ohms, ½ watt
R_{11}—0.5 megohm, ½ watt
R_{12}—100,000 ohms, ½ watt
R_{13}—400 ohms, 10 w.
R_{14}—10,000 ohm tone control
R_{15}—50 ohm semi-variable c.t.
R_{16}—200 ohm potentiometer
T—6F6 to 500 ohm line transformer

four rubber mounting feet. Gain control and an optional tone control are mounted on the front panel as are a B-lead on-off switch, an indicating pilot light, and the receptacle for the diaphragm type crystal mike. The panel layout is really rather unusual but leaves nothing to be desired, either in eye-pleasing placement of controls or in functional design. The mike receptacle, you will note, is in the upper left-hand corner. This permits a grid lead to the first tube (which is positioned immediately behind this item) as short as one inch. A chrome and black drawer-pull picked up in a local "five and ten" not only makes a convenient lift handle but gives the completed instrument a finished and quite attractive commercial touch.

The mike is swivel mounted on an Amphenol plug for direct installation on the panel. Or it can be extended, whichever is desired.

A glance at the "upstairs" chassis view discloses that the input amplifier, the voltage amplifier, and the output amplifier line up right along the chassis toward the output transformer. This is a small, inexpensive, unshielded (but good quality) job matching the power pentode into a 500 ohm line. You will observe that there is or should be plenty of room within the cabinet (on the wall, back panels, or top) for installation of two small a.f. chokes for a band pass or high pass filter system should one be desired.

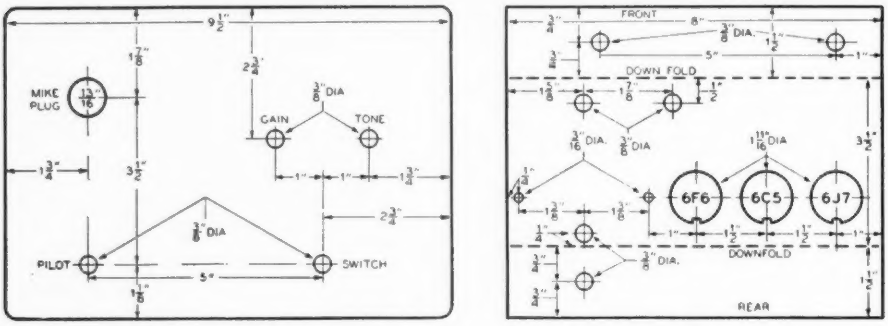
Another glance, this time at the underside chassis view, shows that we have just enough space for the various required resistors and by-pass and coupling capacities. No room to spare, but, as we've just said, room enough.

A male chassis receptacle on the back panel permits connection to the feed cable from the A and B supply. This supply may be anything on hand or a job built up around the suggested circuit illustrated. A two-post output assembly on this same panel or cover (it may be a binding post type or simply an inexpensive screw terminal plate) is provided for connection from the output transformer secondary to a 500 ohm line.

The Circuit

There is nothing very unusual about the circuit. The first tube or mike amplifier in the lab. set-up is a 6J7, pentode connected, with its screen grid fed through a 1 megohm resistor from the point of juncture between two 0.1 megohm ones in the plate circuit. At 250 volts plate supply and with the particular microphone shown in the photograph this particular arrangement was found more suitable to the general design than any others. Be that as it may, some builders will perhaps prefer the use of either a 6F5, a 6B8, or a 6J7 triode connected and we might as well say that any one of these tubes will give perfect satisfaction with some minor changes in wiring and resistor values.

The gain control, a 0.5 megohm potentiometer, determines voltage input to the 6C5 second tube in the line-up and thus, in effect, the



Front Panel and Sub-Panel Layout for Drilling Chassis

gain of not only this unit but the complete a.f. lineup.

Note that C_3 and C_7, the coupling condensers between the stages, are of 0.1 μfd. value. Grid circuits for both V_2 and V_3 are filtered, and plate circuits for V_1 and V_2 are similarly decoupled and provided with r.f. filter capacities to ground. All three cathodes are heavily by-passed with 25 μfd. electrolytics.

The completed job draws about 50 ma. at 250 volts B supply. At this voltage a good three watts can be put into the 500 ohm line. As a matter of fact, the laboratory amplifier has been used for voice p.a. work to a small extent and gives more than adequate output for small assembly hall coverage.

The semi-variable resistor R_{15} may be quite necessary for filament center-tapping to ground and to eliminate hum unless the power transformer 6.3 volt winding is itself center-tapped. C_{14} may be an electrolytic of any capacity great enough to filter out any B supply hum and to provide a low a.f. impedance to ground at the amplifier. It should not be eliminated, particularly if the power supply is to be located some distance away.

C_{12} may or may not be required. C_{11} and R_{14}, the tone control, are optional. Generally, C_{12} will prevent any high frequency "burr" in the response and will be a very desirable refinement. The tone control is of course used to attenuate high frequencies.

Any band pass or high pass filter system would be wired in between V_2 and V_3 and might be of either single or dual section construction. (See Ray L. Dawley's article in Feb., 1937, RADIO for all the filter dope needed).

Construction

As this little amplifier really recommends itself for more or less exact reproduction, we will give complete layout data herewith along with a very few comments and advices on construction.

Consider, first, the cabinet. It will take half an hour, perhaps, to drill. Mount the drawer-pull on its top, the gain and tone controls and the mike receptacle on the front panel, and the power receptable and line terminal assembly on the back cover. Stamp out the chassis socket holes and drill holes for the pilot light assembly and the B line switch. Mount the output transformer and the sockets, positioning the latter for shortest possible leads to other items, and then lock panel and chassis together by means of the securing nuts for pilot light and B switch.

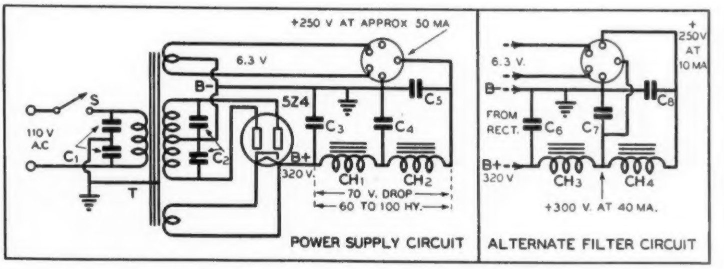
Wiring

We won't bother much with wiring details as most amateurs know just what must be done. Use plenty of tie points, keep grid, plate and other filter circuits where they belong and leads

Nothing Much Under the Sub-Panel Except a Bunch of By-pass Condensers

as short as possible. Raise both coupling condensers well above chassis ground and place them well away from filter condensers. Shield the leads from mike receptacle to 6J7 grid cap and the two leads brought through the chassis to the gain control if trouble is experienced at

C_1—.05 µfd. 600 volt tubulars (line filter)
C_2—.002 µfd. 1000 volt mica
C_3-C_8—8 to 16 µfd. 450 volt electrolytics
CH_1, CH_2 — Filter chokes. Total res., about 1400 ohms
CH_3—30 hy. 400 ohm choke
CH_4—200 hy. 5000 ohm choke
T—Power transformer 700 volts c.t., 60 ma.; 6.3 volts, 1.5 amp.; 5 volts, 2 a.



Power Supply Wiring Diagram, with Optional Filter Circuit

this point. Shielding of the filament leads might be an added refinement.

When the lab. model was first built, neither tne 6C5 nor 6F6 grid circuits were filtered as shown. The result was, with every other precaution taken and regardless of changes in the values for all cathode resistors, that we could not advance the gain control beyond the three-quarter mark without experiencing bad feed-back and motorboating. With the grid circuits filtered this trouble disappeared entirely and we were able to run the gain wide open.

The various filter capacities take up most of the room; hence it will be advisable to use the smallest resistors which can be found.

Suitable Power Supplies

Two circuits are given for suitable power supplies. One affords about 250 volts for all three tubes and one gives 300 volts for the 6F6 and a well-filtered 250 volts for the 6J7 and 6C5. Both have two section filters.

So far as the first circuit is concerned, there may be difficulty in obtaining two chokes with inductance of from 60 to 100 henries and a series resistance such as to give about a 70 volt drop at 50 ma. If so, one can employ a three-section filter and three 30 henry 400 ohm chokes.

The second circuit would be more satisfactory, as it would permit the use of regularly available chokes, afford a higher B voltage for the 6F6, and more or less guarantee humless operation. In both circuits center-tapping of the 6.3 volt power transformer winding to ground will probably be required if the filament circuit is itself not center-tapped, as recommended, at the amplifier.

A complete power unit could be built for very little, as a 50 ma. transformer and two unshielded low current capacity reactors would run to no more than perhaps six dollars list. Etched foil electroyltics are not terribly expensive and the average junk box will disgorge accessory items if put under pressure.

Operation

In testing the instrument the mike should be plugged into its receptacle on the shield can and the gain control opened to full position. A speaker, a 500 ohm line to voice coil transformer, and an extended line will come in handy for ear tests if C.R. equipment is not available.

Place the speaker far enough away and at such a position with respect to the microphone that feed-back is not evidenced. At full gain the hum should be inaudible. If it isn't, make such power filtering readjustments as may seem necessary and try changing the position of a few leads within the amplifier. It is surprising how one or two leads, badly placed, will bring up the hum and how the hum will back out with these leads moved around a little. Shield the filament leads if necessary, and if hum still insists on making itself heard try balancing it out by feeding back from the filament through a blocking condenser to the cathode circuit of an offending tube. Sometimes a metal tube will have a rather low cathode to filament resistance and nothing but replacement will do the trick.

There should be no motorboating or degenerative effects at full gain. Reproduction—granting that the specified output transformer and microphone are employed and that the speaker is capable of translating with good quality and is properly matched into the line—should be found excellent. Plenty of audio power should be had.

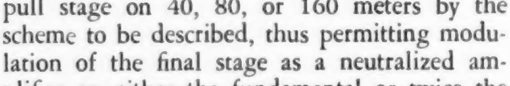
[*Continued on Page 50*]

All Bands with the "Bi-Push"

There are so many possible combinations and modifications under which the "Bi-Push" exciter* can be used, that it would require pages to go into detail on each one. The possibilities offered by variations of the fundamental circuit are endless. However, some of them will be dealt with briefly here, especially those pertaining to the use of the exciter on various bands with different combinations of crystals and coils.

If one studies the wiring diagram until he understands the idea upon which the coil switching is based, it should be possible for him to work out his own coils to suit his own individual purposes in regards to crystals and frequencies, with nothing needed other than the approximate number of turns required for each band.

Many amateurs have written in expressing disappointment that the unit cannot be modulated for 160-meter phone and is only useful as an exciter on that band (because of the fact that it functions as a push-pull 6L6 oscillator on 160 meters). However, the 6L6 stage may be operated as a neutralized push-pull stage on 40, 80, or 160 meters by the scheme to be described, thus permitting modulation of the final stage as a neutralized amplifier on either the fundamental or twice the fundamental frequency of the crystal, depending upon whether one uses either one or both of the 6A6 stages.



BOTTOM VIEWS OF SOCKETS AND FORMS

The original circuit shows the bandswitch labeled "20, 10, 40" for use on those bands. For all band operation, the corresponding positions should be labeled "X, Y, Z." By referring to table A, it is possible to tell from the crystals available and the bands one desires to work just what coils are required and whether they should be connected push-pull or push-push (see diagram). After this has been determined, the correct number of turns for the various bands can be found in table B.

The 40, 80, and 160 meter coils may be wound on standard low loss bakelite forms if desired, but the 20 and 10 meter coils must be wound on high grade ceramic forms (Isolantite, etc.). Probably the most inexpensive combination is to use bakelite XP-53 1½-inch diameter forms for the 160 and 80 meter coils, and XR-20-5 type 1½ inch diameter "half height" ceramic form for the 40, 20, and 10 meter coils. Another combination is to use XP-53 bakelite forms for the 160, 80, and 40 meter coils, and CF-M midget isolantite 1⅛-inch diameter forms for the 20 and 10 meter coils. When using bakelite forms, be sure they are of good material and have low power factor; otherwise, they will heat and waste power.

Permanent Neutralization

By utilizing an extra coil or two it is possible to run the 6L6 amplifier as a *neutralized push-pull* stage, which may be modulated if desired. In other words, when working on the fundamental frequency of the crystal, the 6L6 stage operates as a push-pull cross-neutralized amplifier instead of as a push-pull oscillator. A push-pull coil is inserted in coil socket B and another push-pull coil of the same frequency (crystal frequency) inserted in socket "C". When permanently *neutralized,* the 6L6 stage will *not function as an oscillator,* as there is insufficient feedback to sustain oscillation. However, by using an extra push-pull coil of the same frequency as the crystal it is not necessary to use the 6L6 stage as an oscillator, as the preceding 6A6 can be used to drive the 6L6's as an amplifier on the same frequency.

To neutralize the 6L6 stage, procure two MEX or M-30 compression type trimmers (Isolantite, 3-30 μμfd.) and remove the adjusting screw on each. Take a fine-tooth hack saw blade and saw the tips off the stationary plate so that more clearance will be provided between it and the eyelet that holds the movable or compression plate. When this is done to each condenser, they may be soldered into the circuit, cross connected from plate to grid

*RADIO, April 1937, page 8, and May 1937, page 64.

TABLE A

Output	Xtal and Coil Sockets				S_1
	X	*A*	*B*	*C*	
160		160 X	160 Pull	160 Pull	X
80		80 X	80 Pull	80 Pull	X
80		160 X	160 Pull	80 Push	X
40		40 X	40 Pull	40 Pull	X
40		80 X	80 Pull	40 Push	X
40	80 X	80 Pull	40 Push	40 Pull	Y
40	160 X	160 Pull	80 Push	40 Push	Y
20		40 X	40 Pull	20 Push	X
20	40 X	40 Pull	20 Push	20 Pull	Y
20	80 X	80 Pull	40 Push	20 Push	Y
10	40 X	40 Pull	20 Push	10 Push	Y

Coil combinations and connections for all band operation when using either neutralization or screened tubes in the final stage of the "Bi-push" Exciter-Transmitter.

on the 6L6's with as short leads as possible. The stage is then neutralized in the conventional manner by bending the movable plates in and out. The mica sheet and adjusting screw are both removed. Very little capacity is required to neutralize 6L6's, and these revamped trimmers provide a very inexpensive method.

If this system of neutralization is used, no changes are required in the circuit as shown last month except for the addition of the neutralizing condensers. When once correctly set on 80 meters, the neutralization will hold for 40 and 160 meters, making it unnecessary to touch the condensers when going on any band from 10 to 160 meters. The neutralizing capacities have no effect at all upon the operation of the 6L6 stage when operating as a push-push doubler. They merely double the effective plate-grid capacity of each 6L6, which is very low anyway. When working push-push, the 6L6 stage "doesn't know the neutralizers are in the circuit."

If this method of all-band operation is used (with neutralizers), it will be necessary to refer to table A for coil connections. Table A also applies when one uses 807's or RK-39's (late shielded type) in place of 6L6's in the last stage. However, it is cheaper to buy two 18-cent compression trimmers and use 6L6-G's. Incidentally, the older type RK-39 will require neutralizing the same as a 6L6. Only the newer ones are well-screened. Regardless of whether one *neutralizes or uses screened versions of the 6L6*, the last stage *cannot be used as a crystal oscillator* and it will be necessary to use an *extra coil and follow table A* in order to work on the fundamental frequency of the crystal.

While the foregoing is not particularly complicated, it may be confusing to some, and unless you wish to modulate your Bi-Push on 160 meters perhaps the best bet is to ignore this article and use the exciter as described in the April and May issues of Radio.

TABLE B

160 Meters
70 turns c.t. no. 22 enam. close wound, 1½" dia.

80 Meters
34 turns c.t. no. 22 d.c.c. close wound, 1½" dia.

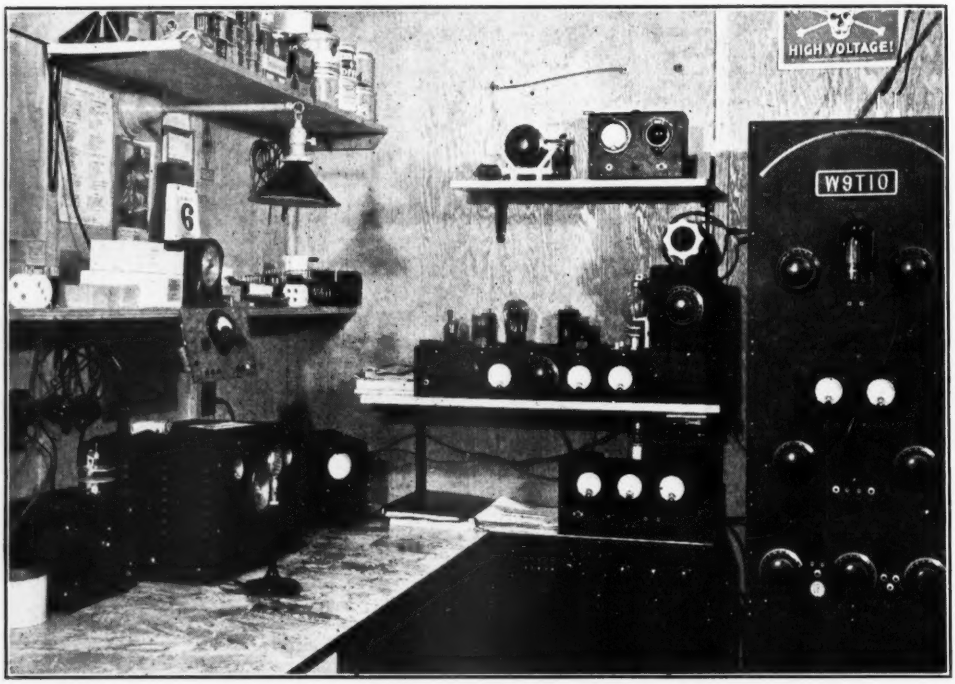
40 Meters
18 turns c.t. no. 18 d.c.c. close wound, 1½" dia.

20 Meters
8 turns c.t. no. 16 bare, spaced to 1⅛", 1½" dia., *or* 11 turns same 1⅛" dia. spaced to 1⅜"

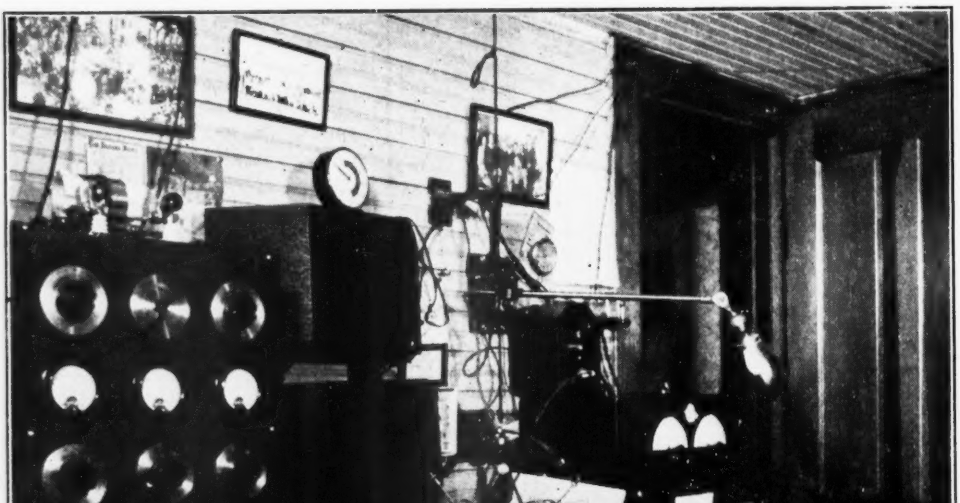
10 Meters
3½ turns no. 16 bare, spaced to 1⅛", 1½" dia., *or* 4½ turns same 1⅛" dia. spaced to 1⅜"

Connect coils as required. See coil diagram.

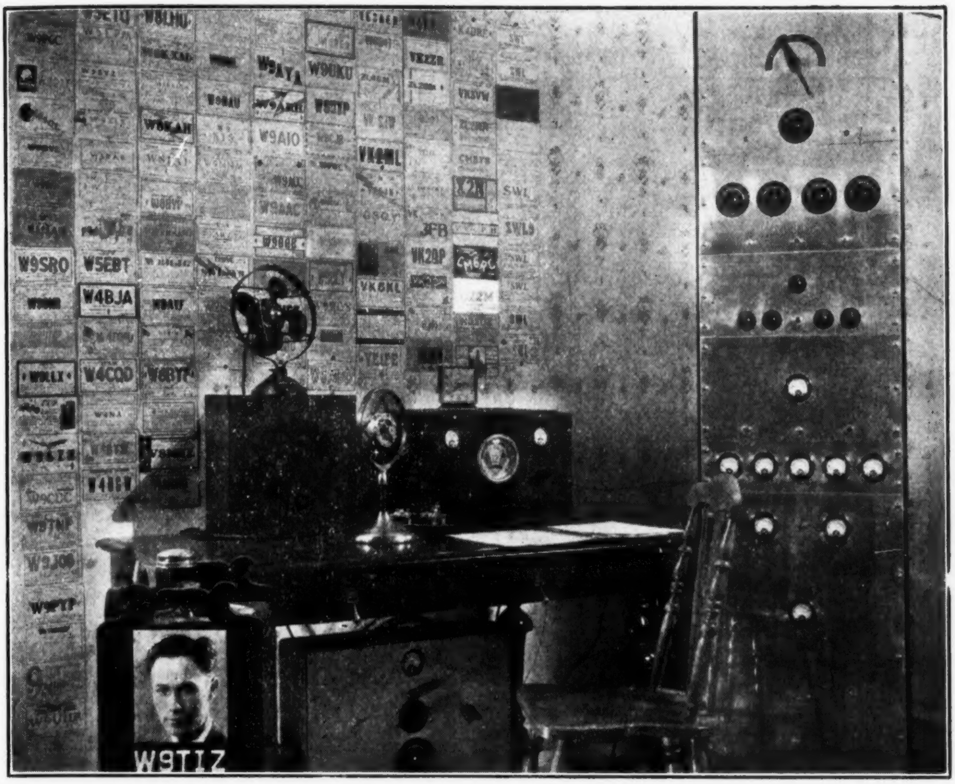
Four Prominent Ninth District Phones



W9TIO, Slater, Iowa. Push-pull 50-T's on 75 and 160 meters, a single 354 on 10 and 20 meters.



Portable W9VZP, Zearing, Illinois, headquarters of the Black Cat Radio Club (organized on Friday the 13th, 13 charter members).

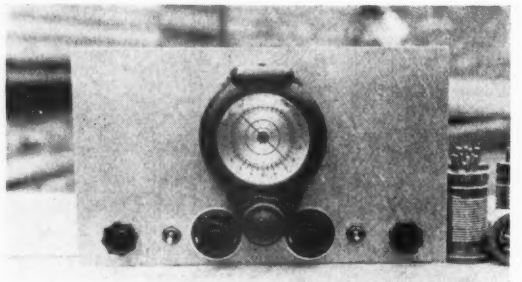


W9TIZ, Chicago, often-heard call on the phone bands. One kilowatt input to a pair of 150-T's.

W9VXZ, Minneapolis, Minn., station of the N.I.T. radio club. Left to right are W9AVH, W9JQI, W9WGH, and W9VXZ (to whom the station call is made out). T-200's at 1 kilowatt input are modulated by HD-203A's.

A "De Luxe" Two Volt, Battery Superhet

By Harry D. Hooton,* W8KPX



In developing the "de luxe" 2-volt super-heterodyne described in this article, the author's primary purpose was to provide a dry-battery-operated receiver designed especially for short wave work which would insure good loud speaker reception from all parts of the globe.

It was decided at the outset that the receiver must be simple to construct and operate, and, as very little test equipment was at hand, easy to align after it had been built. Also, the drain on both the A and B batteries must not be excessive; losses in both the r.f. and i.f. circuits must be kept down to the very minimum; and the gain in the r.f., i.f., and audio circuits must be high enough to bring any signal, strong or weak, up to full speaker volume with no trace of instability. In addition to these essential features it was decided that every type of control that had been found useful in previous sets would be placed on the front panel to obtain maximum tuning flexibility. The result is the six-tube superheterodyne receiver illustrated and described herein.

The circuit shown in the schematic diagram consists of a 1C6 as mixer-oscillator; two 1A4's as i.f. amplifiers; a 1B5/25S as detector, a.v.c., and first a.f.; a 30 as second a.f.; and a 1F4 as the output tube. The range is from approximately 9¼ to 550 meters and is covered by means of the 140 μμfd. tuning condensers and the six pairs of plug-in coils. As the diagram indicates, the three i.f. transformers are of the iron-core type and are tuned to approximately 456 kc.

Mechanical Construction

As the photographs and drawings show, the set is built up on a 7 x 11 x 2 inch electralloy chassis and a 7 x 12 inch aluminum panel. Reading left to right, the various controls on the front panel are as follows: tone control, filament and B minus "off-on" toggle switch, a.f. volume control, tuning dial, r.f. and i.f. gain or sensitivity control, a.v.c. "off-on" toggle switch, and at the extreme right the 35 μμfd. midget condenser across the mixer grid coil. The filament rheostat, the speaker and head-phone tip-jack and the necessary binding posts are set at the rear of the chassis where they are out of the way when tuning. Complete data for cutting and drilling the chassis is given.

The actual construction of the set is not at all difficult but must be done carefully. The i.f. transformers are already pre-tuned or peaked at the factory, which eliminates most of the aligning difficulties so common in home-made supers. Do not, however, under any circumstances tamper with the adjusting screws of the i.f. units or subject them to shock or jar until they are wired into the circuit and the set is in operating condition! If this precaution is not observed, it may be impossible to bring the circuits into their correct alignment without a service oscillator and output meter.

Keep the leads, especially those from the plug-in coils to the 1C6 socket and the wires from the i.f. transformers to the grids, plates, and diodes of the 1A4 and 1B5 tubes, as short and direct as possible. Be sure to solder each connection with rosin-core solder and a hot, clean, and well-tinned iron. The solder should be sweated into the joints thoroughly as a high-resistance connection in either the r.f. or i.f. circuits may impair the efficiency of the receiver or make it noisy in operation.

Shielding of the usual braided type must be used on the B plus, a.v.c. grid, and diode leads as indicated by the dotted lines in order to prevent oscillation and noise at the i.f. level. The shields must be rather large (from ¼ to ½ inch in diameter) and must be left loose in order to keep the losses from capacity effects as low as possible. Ground each shield to the B minus (chassis) line and solder the connection; noise in a high-gain receiver of this type often can be traced directly to a loose or poorly grounded piece of shielding. All leads

*5 Mile Road, Henderson, West Va.

not shielded, and this applies to battery and a.f. wiring as well, are placed flat against the metal chassis in order to limit their external fields.

When the wiring has been completed and the set is ready to be tested, place the tubes in their respective sockets with their grid clips in position and connect the "A" battery (3-volts) to its leads. Using a voltmeter of about 0-5 volts range, adjust the filament rheostat until the meter reads exactly two volts at the filament terminals with the "A" toggle switch in the "on" position. If no indicating instrument is available, turn up the rheostat to the point where the filaments glow at a dull cherry-red color which is difficult to distinguish in a bright light.

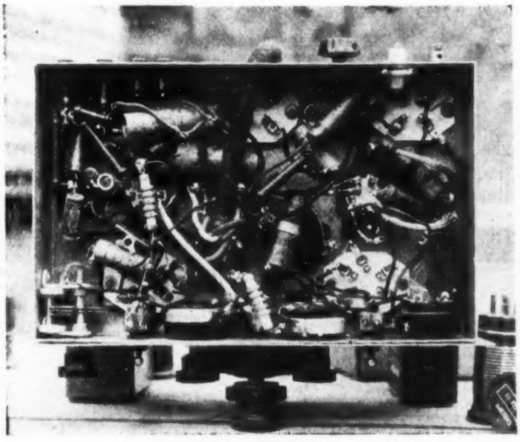
It is advisable, before the B and C battery power is applied, to test from each B plus and C minus connection to the chassis (negative filament) in order to determine whether any "short circuits" are in existence. A pair of head-phones and a 4½-volt C battery will serve for this purpose and a "short" is indicated by a loud click in the head-phones every time the contact is made and broken. If the circuit is normal, a loud click should be heard the first time, due to the charging of the by-pass condensers, and very weak ones or none at all on

COIL DATA

Range	*Ant.*	*Mixer Grid*	*Osc. Grid*	*Tickler*	*Spacing*
9¼-17	2½	3	3	4½	1¼"
17-41	4	8	6½	5	1⅜"
33-75	7¾	17¾	15½	8	1½"
66-150	10¾	38	31	12	1⅝"
135-270	17¾	82	65	15	1⅞"
270-550	17¾	130	110	21	1⅞"

All forms are 1½" in diameter and may be either 4- or 6-prong type. Range given is in meters. Spacing is the distance between the grid and filament ends of the coil, not the space between turns. Wind ticklers in same direction as grid coil and on the grid ends of the form.

Padding condensers required as follows: 9¼-17 meters, none; 17-41 meters, .01 μfd.; 33-75 meters, .006 μfd.; 66-150 meters, .0025 μfd.; 135-270 meters, .001 μfd., and 270-550 meters, .0004 μfd. The larger values are obtained by placing a mica or paper condenser *in parallel* with the variable padder. All trimmers are 35 μμfd. value.

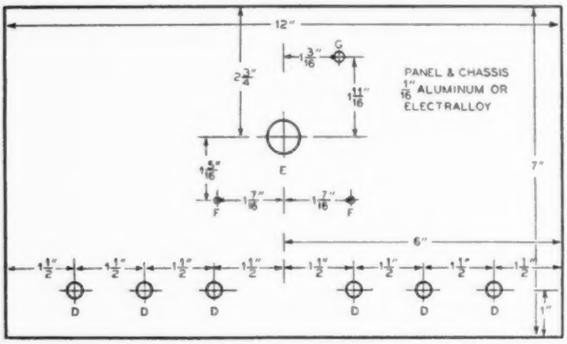


Under-Chassis View of the Receiver

successive contacts. If everything appears to be correct the batteries may be connected as shown and the process of alignment carried out.

It usually is best to align the r.f. and i.f. circuits from the signal of some station operating on the standard 200-550 meter broadcast band; high-frequency signals are poor for this purpose because of their rapid fading characteristics. Place the a.v.c. switch in the "off" position (it is extremely difficult to peak the i.f. stages with the a.v.c. in action) and try to tune in some weak broadcast station operating on a frequency around 1,000 kc. With a non-metallic screw-driver, adjust the padding condensers inside the coil forms until maximum signal volume is obtained. Both the volume and gain controls should be turned full-on during the alignment of the receiver and these must not be disturbed or adjusted in any way until the process is completed. Next, starting with the secondary of the output i.f. transformer, adjust each trimmer in turn for maximum volume. If the volume becomes too great during the adjustment, reduce the input from the antenna to the mixer circuit; do not, under any circumstances, reduce the volume by turning down the volume or gain controls! It usually is necessary to go over both the r.f. and i.f. trimmers three or four times in order to obtain an accurate alignment.

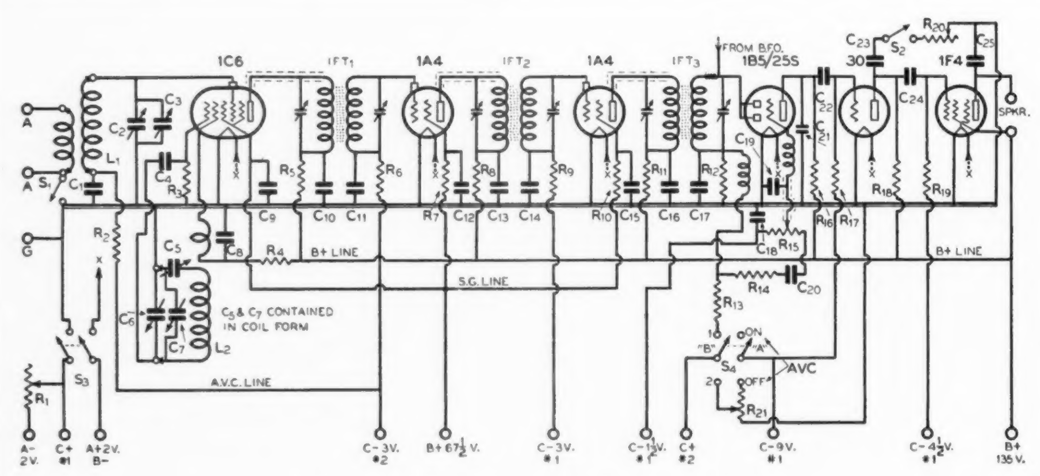
The coils covering the other bands now are placed in their sockets and the padding condensers inside their forms are adjusted for the greatest signal strength as outlined above. The i.f. trimmers are *not* adjusted this time as it is only necessary to align this circuit once. After



the r.f. padders are once adjusted, the tracking between the mixer and oscillator tuned circuits usually will be perfect on both the broadcast and short wave bands; the 35 µµfd. trimmer, however, allows any small differences due to antenna coupling, etc. to be effectively taken care of.

As the photographs show, the coils used with this receiver are all of the manufactured variety. A coil data table, however, is given at the end of this article in case the builder wishes to wind his own coils. The two coils that cover the 10-meter amateur band (9¼ to 17 meters) must be wound with rather heavy wire (no. 14 or 16 enameled will do) and the tickler must be wound on the grid end of the oscillator coil. If this is not done, difficulty in obtaining strong oscillations in this region may be encountered which will make the set seem noisy and insensitive. Likewise on the other ranges, as standard plug-in coils are wound for regeneration rather than sustained oscillation, it usually is necessary to re-vamp the ticklers of the oscillator coils. In most cases the new windings will contain about 1/3 more turns than those originally used.

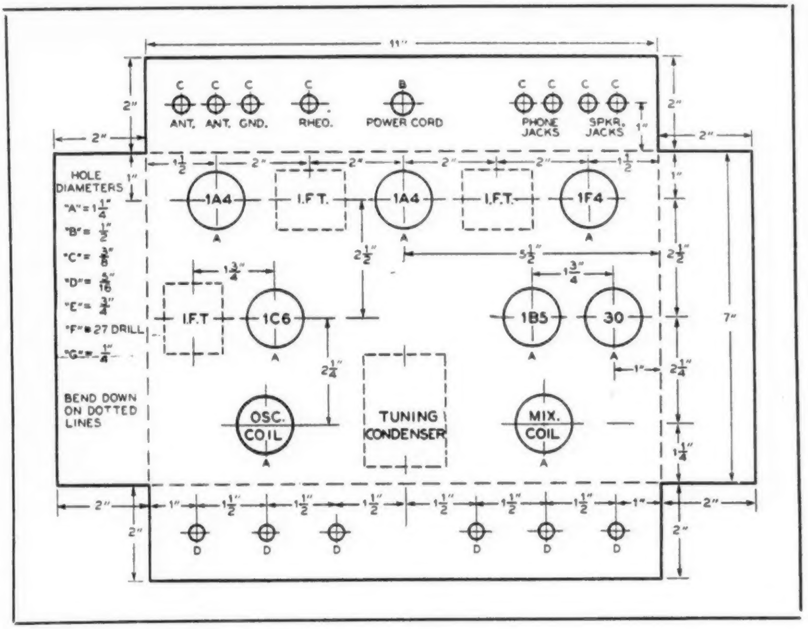
The tuning and operation of the various con-

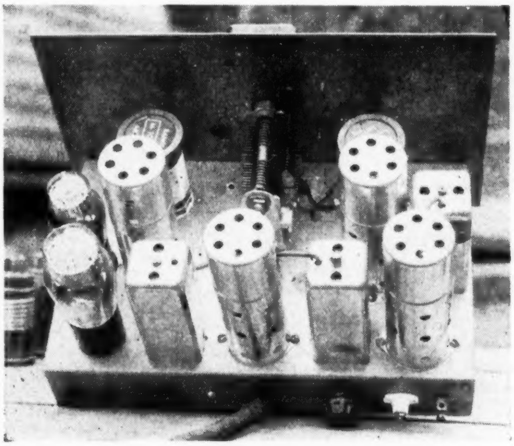


Schematic Wiring Diagram of the Superhet

C_1—.05 µfd. 400 volt tubular
C_2,C_6—Dual 140 µµfd. midget
C_3—35 µµfd. midget trimmer
C_4—.0001 µfd. mica
C_5—Padder condenser. See coil table.
C_6, C_2—Dual 140 µµfd. midget
C_7—Oscillator trimmer condenser. See coil table
C_8—0.1 µfd. 400 volt tubular
C_9,C_{10}—0.1 µfd. 400 volt tubular
C_{11}—.05 µfd. 400 volt tubular
C_{12},C_{13}—0.1 µfd. 400 volt tubular
C_{14}—.05 µfd. 400 volt tubular
C_{15},C_{16}—0.1 µfd. 400 volt tubular
C_{17}—.00037 µfd. mica
C_{18}—0.1 µfd. 400 volt tubular
C_{19}—.0005 µfd. mica
C_{20}—.05 µfd. 400 volt tubular
C_{21}—.001 µfd. mica
C_{22}—.01 µfd. 400 volt tubular
C_{23}—.03 µfd. 400 volt tubular
C_{24}—.01 µfd. 400 volt tubular
C_{25}—.006 µfd. 400 volt tubular
R_1—6 ohm rheostat
R_2—100,000 ohms, ½ watt
R_3—50,000 ohms, ½ watt
R_4—25,000 ohms, 1 w.
R_5—20,000 ohms, 1 w.
R_6—100,000 ohms, ½ watt
R_7—10,000 ohms, ½ watt
R_8—20,000 ohms, 1 w.
R_9—100,000 ohms, ½ watt
R_{10}—10,000 ohms, 1 w.
R_{11}—20,000 ohms, 1 w.
R_{12}—250,000 ohms, ½ watt
R_{13}—250,000 ohms, ½ watt
R_{14}—50,000 ohms, ½ watt
R_{15}—500,000 ohm potentiometer
R_{16}—250,000 ohms, 1 watt
R_{17}—1 megohm, ½ w.
R_{18}—250,000 ohms, 1 watt
R_{19}—1 megohm, ½ w.
R_{20}—50,000 ohm potentiometer
R_{21}—50,000 ohm potentiometer
L_1,L_2—See coil table
$IFT_{1,2,3}$—456 kc. iron core intermediates
S_1—Antenna coil ground switch
S_2—Tone control on-off switch
S_3—Receiver on-off switch
S_4—AVC on-off switch

trols is extremely simple and easy. The dial shown on the receiver is the new two-speed front panel mounting type having dual ratios of 30:1 and 165:1. This actually allows razor-edge adjustments to be made on any signal no matter how weak or distant it may be. Normally the a.v.c. action is left on while tuning. By placing the toggle switch in the "off" position, however, the a.v.c. is cut out and the 50,000 ohm gain control and 9 volts of C bias are connected in the circuit. The negative voltage applied to the control grids of the mixer and the first i.f. tubes may be adjusted to any value between 3 and 9 volts by means of this potentiometer. Generally better reception in the vicinity of the





10-meter amateur band will be obtained with the a.v.c off. When the action is left on, weak and rapidly fading signals frequently are "wiped out" altogether. Always place both toggle switches in their "off" positions before leaving the set; otherwise, there will be a considerable drain on the C batteries through the 50,000 ohm control, which will shorten their life appreciably.

Having progressed thus far, most readers undoubtedly will wish to know just what results may be expected from the receiver. At the author's home in West Virginia (which is far removed from being the ideal receiving location) Australian amateur phone stations operating on inputs as low as 35 watts have been heard on numerous occasions with good speaker volume. Also, the British, German, and other popular foreign stations are received with almost local-like regularity and volume. The antenna used is a single wire 15 feet high and 30 feet long.

The author is interested in hearing from those who build this receiver and all letters will be answered if a *stamped and self-addressed envelope* is enclosed for reply. Letters should be sent direct to the author at Henderson, West Va.

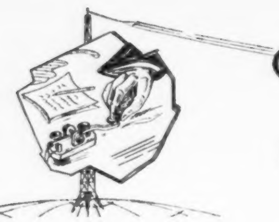
◆

The amateur influence again: Known to the trade as "5 meter" diathermy and fever machines, the frequencies of these contraptions invariably fall between 6 and 9 meters. A dentist we know is quite proud of his "5 meter" machine. The gadget oscillates on 8 meters. He is not a ham, but can give you a fine dissertation on why "five meters is great stuff".

◆

We understand that one of the W6 boys acquired a bad case of sunburn during the recent dx contest while rolling up his 50 odd thousand points . . . from the mercury vapor rectifiers feeding his California kilowatt.

Incidentally, the Aussies refer to them as *Californian* kilowatts.



CALLS HEARD AND DX DEPARTMENTS

Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, not to Los Angeles.*

Jack Spall, VE3ER, 70 Fairview Avenue, Toronto, Can.

(Feb. 18 to April 10.)

(14 Mc.)

CN8MI; — D 3CDK; 3DSR; 3GKR; 4ALL; 4BMU; 4CDK; 4CEM; 4GAD; 4GFF; 41FG; 4SNP; 4ZSN — F3LE; F3PK; F8AB; F8AF; F8FC; F8QW; FA8IH — G 2PU; 2RU; 5BJ; 5IW; 5QG; 6AB; 6GH; 8DQ; 8HA; HA8C; HB9BY; HH5PA; HK1JB; I1TKM; I1RRA; K6BNR; K6JLV; K6NYC; LA1H; LU9BV; OE7EJ; OH3OL; ON2A; ON4A; ON4AW; ON4CG; ON4FK; ON4VW; ON4ZSI; OZ9Q; PA0ATK; PA0CE; PA0GN; PA0KK; PA0OK; PY1HB; PY2AC; PY2HX; PY8AH; SP1CM; SP1GZ; SP1MF; SU1CH; SU1SG; TI2LR; U1AD; U6AH; U9MF; U9MI; UK3AK — VK 1JB; 2BX; 2PK; 2PN; 3AA; 3JT; 3VF; 4EL; 7JB; 7LC; VP1WB; VP2AT; VP4AL; VP7WS; YR5CF; YR5HC; YR5IG; YV5ABE; ZB1P — ZL 1DM; 1DT; 1LM; 2BX; 2DH; 2HR; 2MN; 2QM; 2SX; 3AN; 3GR; 4AO; 4GG; ZT1R; ZU1AC.

Petr. Jastrzembskas, LY1J, Hipodromo 14, Kaunas 1.

Dec. 17, 1936.

(7 Mc.)

W 1JHQ; 2BK; 2FA; 2GUU; 2IRV; 3AFG; 8FBX; 8LPK; 8QLR; ZL2BV.

(14 Mc.)

W 1AXA; 1BFT; 1FMQ; 1GNE; 1IQH; 1LZ; 1RR; 2ALW; 2CYS; 2DHS; 2DPA; 2DY; 2ENO; 2FAR; 2FLI; 2FWX; 2FZ; 2GIZ; 2GJF; 2ICO; 2IQY; 2JZ; 2MDQ; 3ADA; 3ANS; 3CVK; 3DBD; 3DQO; 3EJO; 3ENX; 3EPR; 3GHD; 6DXM; 6GCT; 6MPK; 6NKY; 6ETK; 8AAT; 8CJJ; 8CKU; 9AAS; 9GIX; 9PTC; 9UBS; AC4YN; CN8AP; CT3AD; FT4AC; LU2CW; LU3EV; LU8EN; MX2B; PK1BX; PK1RL; PK3MP; PY2DN; PY2DO; PY2HM; PY2HN; PY4AP; PY5QD; SU1DB; TI3J; VE1BK; VE4TX; VK3CW; VK3CX; VK5LN; VK6FO; VP4TH; VP5AF; VS7RF; VU1CQ; YV5AA; ZC6AQ; ZE1JG; ZE1JV; ZE1JZ; ZL1KE.

(Jan. 3.)

(7 Mc.)

W 2DFN; 2DTR; 2FA; 2GUU; 2ICO; 2IRV; 3AFV; 3EYS; 4AUU; 4DRD; 8LPK; 8QLR; CR7GF; CT2BO; J2CZ.

(14 Mc.)

W 1BQU; 1FID; 1GXY; 1KAD; 2ACW; 2AON; 2FSD; 3BBB; 3CMS; 3ENX; 3EV; 3JAU; 3JVA; 4CVQ; 4DHZ; 5QU; 6GCT; 6MPK; 7FH; 7JAU; 8EOF; 8FBX; 8NJP; VU2JN; ZE1JZ.

E. J. Murphy, W1IFK, 191 Cold Spring Road, Stamford, Conn.

(Jan. 20 to Mar. 12.)

(7 Mc.)

CT1AR; CT1BQ; CT1EL; CT1EQ; CT1KW; CT1PX; CT2BO — D 3CDK; 3CFH; 3HDJ; 4BUF; 4DLC; 4GFF; 4HCF; 41ZI; 4JUD; 4JWV; 4KLU; 4KSD; 4MNL; 4NXR; 4OYT; 4SNP; 4SXR; 4WER; 4WLL; 4WXD; 4XQF; 4YBF; 4YFI; 4YLI; 4YVM; 4ZVB; EA1AY; EA9XX; EI5C; EI5C; EI8B; F8AZ; F8EB! F8MW; F8YW; FA8LPR; FM8AD; FT3AK; GI2AO; GI2LC; GI2PL; GI5QX; GI5UU; GI6KP; GI6OD; GI6TM; GI6VQ; BI8HK; HA4H; HA8C; HA8D; HAFLB; HAF8I; HB9BE; HB9BK; HB9BN; HB9BX; HC2MO; HH2M; HK5JW; I1SR; K5AC; K5AF; K5AM; K6DSI; LA2C; LA2W; LA6T; LU2BD; LU9DQ; LY1AD; OE3AH; OE5JB; OE6AX; OE7FW; OE7JH; OK1AQ; OK1CB; OK1CS; OK1KX; OK1VK; OK1WZ; OK2HJ; OK3LO; OK2MM; ON4ABO; ON4DA; ON4DS; ON4IF; ON4NO; ON4NRA; ON4OB; ON4SL; ON4XA; OZ2EA; OZ2M; OZ3X; OZ9U; PA0UV; PA0QF; PA0AZ; PA0UN; SP1CU; SP1DT; SP1IJ; SM5QU; AU1SG; SV1SM; SX3A; U4ID; U5YH; VK3SG; VK3XS; VK6SA; VO4Y; YP7NR; YV4AT; YV5AA; YV5AE; YV5AK; YV5AN; YV5AV; YSLFM; YM4AA; YR5AA; YU7DX; ZL2IW; ZT1A; ZU1T; ZS2A.

Stephen Casey, 901 State Street, Perth Amboy, N. J.

(14 Mc. phone.)

CE1AH; G2PU; G5ML; G5NI; G5RV; HI5X; HI7G; OA4AD; OA4AK; OA4N; ON4VK; ON4ZE; PA0MQ — VK 2AZ; 2AT; 2OQ; 2OZ; 3LA; 3PL; 3RW; 3ZL; 4JV; 5AI; 5FL — XE1BT; YV1AD; YV1AP; ZE1JR.

(14 Mc.)

D 3BMP; 3GRR; 4ANP; 4DSR; 4GAD; 4GOF; 4LAJ; 4MNL; 4QN; 4WXD; 4XCG; 4YBF; 4YLI; 6JPD; EI9J; F8OK; F8SN; F8TQ; FA8DA; FM8AD — G 2DO; 2HT; 2IM; 2LB; 2LC; 2NQ; 2NS; 2PL; 2SD; 2SX; 2TR; 5BM; 5CL; 5DR; 5KA; 5PL; 5RI; 5RV; 5SS; 5WP; 5YH; 6CL; 6LK; 6MC; 6XL; 8AB; 8DL; 8HO; GI6TK; GM2JF; HA2N; HA8C; HA8D; HB9BY; HI5X; I1IV; J2MH; LU4DQ; LU7BH; OA4Q; OE1ER; OE7EJ; OK2LO; OK2MB; OK2OP; OH5NR; ON3NP; ON4DA; ON4IF; OZ2M; OZ3X; OZ7HH; OZ9Q; PA0AZ; PA0PD; PK3BM; SM5QR; SM5ZS; SM6WL; SM7HO; SM7IC; SP1BA; TI2LR; U3AG; U9MF; VK 2AD; 2DG; 2DK; 2EX; 2IG; 2NN; 2PN; 2RA; 2TY; 2X; 3CP; 3DD; 3DM; 3EO; 3FM; 3HT; 3NG; 3UW; 3UX; 4CU; 5HG; 5ML; 6CL; 6NL; 6SA; 6SW; 7CL — XE1CM; VP5UZ; YM4AA; ZA1V; S1LL; Z1LLM; ZL2FS; ZL2GR; ZL2MM; ZL2MN.

Alois Weirauch, OK1AW, Mestec Kralove, Czechoslovakia.

Nov. 1 to Dec. 31, 1936.

(28 Mc. phone.)

W1IAS; W1ZD; W2AOG; W8BLW; W9CSI.

(28 Mc.)

W 1CPM; 1DZE; 2DPA; 2FAB; 2GIZ; 4DBU; 5AFZ; 6JJU; 8CJM; 8NYD;9BPU; 9ICW; 9KFA; D4QBA; D4XCG; EI2L; EI5F; EI6G; EI8B; EI9D; F8EO; G6LK; GI6WD; HAF3D; OH7NF; OH7ND; OH7NJ; OK1BM; OK2RM; OZ8G; PA0GG; SM6WL; SU1SG; UDMI; VE2AC; VE2KA; VK2GU; VU2AU; ZELJU; ZS1H.

J. Vincent McMinn, NZ16W, 12 Edge Hill, Wellington, C-3, New Zealand.

(Jan. 1 to 31.)

(14 Mc. phone.)

W 1DM-7; 1ADZ-7; 1GOJ-7; 2AD-6; 2CWC-6; 2IXY-6; 3CBT-6; 3CUB-7; 4CYN-6; 8NWV-6; CO2SV-6; CO8YB-7; EA9AH-6; F8II-6; F8QD-6; G2AK-6; G6HW-7; HK3JA-6; HZ1AA-5; K6FKN-7; K6NTV-7; KA1KY-6; LU1DA-6; LU4BL-6; LU5FG-6; LU9BV-7; NY2AE-8; OA4AB-6; OA4AI-7; OA4AK-5; ON4VK-7; PK3WI-6; PY2BA-7; SU1CH-7; VE1DQ-7; VE2DC-6; VE3EO-6; VS7MB-7; VS7RA-7; VO1I-6.

(7 Mc.)

D3BIT-5; D3BWK-4; D4SWR-5; F3AI-6; F3KH-6; F8FK-6; G8FZ-6; HB9CN-5; J5CC-7; J5CL-6; JRCS-5; O43AH-6; OE7AB-5; OZ5Z-5; PA0AZ-6; SP1CM-5; SP1EB-5; SP1IB-5; SP1IH-5; ST1AT-6; U2AO-5; U3BX-6; U5OF-6; U5YH-6; UK1AA-6.

(14 Mc.)

CM2AZ-6; CT1AH-5; CT1EL-5; CT1EQ; CT1LZ-6; CT1MS-6; CT1PC-6; CN8AN-6; CN8MI-4; CR9AA-5; CX1BO-5; D3BIT-5; D3BMP-6; D4DEB 5; D4HEF-6; D4GNM-5; D4SNP-6. F 3AD-5; 3AK-6; 3GS-5; 3LE-4; 8EX-5; 8LG-5; 8NV-6; 8SN-6; 8VD-4; 8WK-6; 8XC-7; 8YZ-5; 8ZZ-5. FA8BG-5; GA8DA-6; FA8IH-7; G 2MI-5; 2SX-6; 2XN-5; 2ZP-6; 5BO-5; 5IB-5; 5IV-5; 5IW-6; 5KG-5; 5TH-5; 5YG-5; 6CW-6; 6DL-6; 6DT-6; 6RH-5; 8DL-5. HAF5C-6; HAF8D-7; HB9AK-6; HB9BD-6; HB9S-5; HS1RJ-8; I1ER-5; I1TKM-6; K4RJ-6; KA1MD-5; KA1PT-7; KA7NU-6; LU1MC-6; OK2OP-7; OK2AP-6; OK2PN-7; ON4FE-6; ON4FD-6; ON4FK-6; ON4FQ-5; ON4PA-6; ON4ZI-5; PA0DZ-5; PA0JV-31; PA0KW-5; PA0LR-5; PY1BR-6;

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*George Walker, Assistant Editor of RADIO, Box 355, Winston-Salem, N.C., U.S.A.

PY1IF-7; PY2AC-5; PY2BU-5; PY2DO-6; PY2JO-5; PY3BYP-7; SM6QN-5; SP1DU-5; SU1FS-6; SU1KG-6; SU1S-6; SU1WM-5; U9AL-4; VE1EA-6; VE1FB-4; VE1IW-8; VE2IY-6; VS8AA-6; VU2BN-6; VU2FH-5; VU2JP-6; XE1AL-5; XE1CS-5; XE1DA-6; XE1FS-5; XU3DO-6; XU8NA-6; YR5CD-6; ZB1H-6; ZE1JB-5; ZE1JF-6; ZE1JT-4; ZE1JR-5; ZP2AC-5; ZS6A-5; ZT5P-5; ZT6Y-5; ZU5D-4; ZU6AF-5; ZU6P-5.

R. L. Weber, W6JOH, 1226 Sherman Street, Alameda, Calif.

(March, 1937.)

CO2MH-5; CP1AA-5; D3KSD-5; D4OQP-4; D4YLI-4; F3LE-3; F8GQ-3; F8LO-4; F8RR-6; F8TQ-6; G2DH-6; G2MI-8; G2NH-6; G2ZQ-7; G6LC-8; G6MC-4; G6NF-7; G6RB-8; G6XN-6; GM2JF-4; HA2L-6; HA8C-4; J6DP-3; K7ANQ-6; KA7EF-5; LU2AZ-5; LY1AF-4; OK3FL-6; OK3PN-3; OZ3D-5; PA0AZ-5; PA0GN-5; PA0KK-5; PA0QF-5; PA0QQ-7; PA0UN-5; PK1RL-5; PK2AA-4; SM5VW-7; SM6QP-4; SM6SO-7; TI2LR-6; U3QT-5; VK3CT-5; VK3IW-6; VK3UK-6; VK4EL-8; VK4JX-7; VK4RC-7; VK4VW-5; VO1P-7; VP1WB-4; VP5PZ-8; XU8JR-6; ZS1AL-5; ZS1AN-4; ZU2B-5; ZU6E-4.

J. G. Kuespert, W9WCE, 706-29th St., South Bend, Ind.

January through March, 1937.

(14 Mc. phone.)

CM2WZ; CO2WZ; E1LA; HK1GK; HP1A; OA4AK; OA4C; OA4N; PY8AE; VO1I; VO1P; VP6FO; VP7NA; XE2N; YV1AC

(7 Mc.)

CM2AS; FA8BG; FM8AD; HAF8C; K5AC; K6DV; K6IDK; K6ILT; K6IBH; K6LKN; K6NXD; NY2AE; OK1CS; VK4EK; XE2BJ.

(14 Mc.)

CE3AR; CM2AD; CM2AZ; CM2RZ; CM5CX; CM7AB; CM8AP; CM8BY; CN8MI; CT1GC; CT1PC; CT1BU. D 3CUR; 4DLC; 4QET; 4QFT; 4SNP; 4SXR; 4UVD; 4WXD; 4XBG; 4XCG; 4YBF; 4YLI; EA4GE; EI4J; EI5F; EL2A; F 3AK; 3CK; 3CX; 3KH; 3MD; 8AZ; 8EO; 8FC; 8FK; 8LG; 8NY; 8RR; 8UK; 8ZU; FA8BG; FA8DA; G 2BY; 2DC; 2DK; 2GC; 2KI; 2LC; 2PL; 2PU; 2TR; 51W; 5MS; 5QA; 5TO; 5UZ; 5WP; 5XB; 5YH; 5YV; 6BS; 6CJ; 6CL; 6GH; 6KU; 6NJ; 6UR; 6VC; 6VP; 6WY; 6YU; 8AB; 8CT; 8CV; 8FZ; 8HI; 8IK; 8IW; GI6TK; GM2WL; GM5YG; GM6IZ; GM6XI; HA7N; HA7TS; HA8C; HA8D; HC2CG; J2MH; K 4BU; 4UG; 5AA; 5AC; 5AJ; 5AY; 6AKP; 6COG; 6HPD; 6MAW; 6MTH; 6MXM; 6OLS; 7FST; 7FYI; 6PQ; LA1H; LA2B; LA2X; LA3H; LU1JH; LU4DQ; LU5AN; LU6JB; LU7AZ; LU7BH; LU9BV; LY1KK; OA4AK; OA4AQ; OA4J; OE3AH; OE7EJ; OH2NB; OH3NP; OH6NS; OK1ZB; OK2MM; OK2OP; ON4FE; ON4FT; ON4VU; PA0AD; PA0CE; PA0DS; PA0MG; PA0AK; PA0OO; PA0QQ; PA0AM; PY 1BR; 1BDW; 1IF; 2AR; 2BX; 2DN; 2EA; 2EJ; 2GS; 8AE; 8AH; SM5LS; SM5QP; SM6SS; AP1DU; U2NC; U9AL; VK 2ADN; 2AEK; 2AFM; 2DK; 2FM; 2GV; 2HP; 2IG; 2JY; 2NO; 2QM; 2VL; 2VT; 3AL; 3CA; 3CP; 3DD; 3EO; 3GP; 3IW; 3JK; 3JT; 3JX; 3MR; 3UH; 3VW; 3WL; 3XP; 3XQ; 3ZF; 4AP; 4HR; 4LE; 4PR; 4RM; 5A1; 5PN; 5WR; 6SA; 7NG; VO1P; VO4Y; VPLAA; VP2CD; VP5AD; VP6MO; VP6MR; VP7NA; VQ8AA; XE1DA; XE2BJ; XE2N; XE2V; XE3AC; ZL 1CE; 1CK; 1CV; 1HH; 1HY; 1JY; 1JZ; 1LZ; 2BU; 2EX; 2FA; 2FS; 2HA; 2HR; 2LB; 2MO; 2NJ; 2QM; 2AX; 3JR; 3JX; 3UU; 4AO; 4BQ; 4DQ; 4FW; 4GM.

Donald W. Morgan, 2CBG, 15, Grange Road, Kenton, Middlesex, Eng.

(Feb. 1 to March 1.)

(14 Mc. phone.)

W 1AQM; 1BLO; 1COJ; 1CRW; 1FD; 1FLH; 1GCX; 1ILQ; 1UH; 2AHS; 2CWC; 2GSC; 2GZZ; 2HBI; 2KZO; 2JDX; 3ACX; 3AMH; 3ANH; 3BNA; 3CNR; 3CQF; 3DLL; 3EOZ; 3FIH; 3FII; 3NZV; 4AGB; 4AVK; 4AZK; 4BMR; 4BYY; 4CRX; 4DXP; 4DYP; 4EJA; 4HX; 4NNZ; 4UP; 8BPV; 8CUO; 8DIA; 8ENY; 8IRK; 8LNE; 8MNX; 8MXQ; 9BMB; 9CNJ; 9ERA; 9RUK; 9WVW. CO 2HF; 2JJ; 2KL; 2LL; 2ZY; 6MT; 7AA; 7AS; 7CX; 8YB; CN8AA; CN8AM; CN8MA; CN8MB; CT1AY; CT1OZ; CT1ZZ; CT2AB; CX1AA; EL6G; EI8L; F 3GT; 3KN; 8AK; 8DC; 8MI; 8NI; 8NR; 8QD; 8RV; 8ZH; FA3AY; FA3KY; G 2DL; 2NS; 2TD; 2ZY; 5AT; 5BC; 5CH; 5JO; 5NI; 5PB; 5TO; 5YV; 6JQ; 6WD; 6WN; 6XN; 6XR; 8AH; 8AZ; 8CN; 8CM; 8FZ; 8HI; 8KX; 8LY; GI2CC; GI2MZ; GI5QX; GI6TK; HAF8N; HB9A; HB9AY; HB9M; HB9X; HI5X; HI7G; HJ3JA; HPLGJ; I1IT; I1SR; I1TKM; LA1G; LA4N; LU1EX; LU2CA; LU2OA; LU4AW; LU4CA; LU6AG; LU6AZ; LU6KE; LU9BV; ON4SS; ON4UF; ON4US; ON4SA; P9OEO; PA0MQ; PA0WN; PA0WV; PY1CK; PY2AC; PY2CK; SM5YS; SM6WN; SP1FD; SU1AP; SU1CH; SU1KG; SU1RO; CV1NK; VE 1AW; 1BR; 1CF; 1DR; 1GH; 1JA; 2BC; 2BG; 2EO; 2KG; 2MC; 3BF; 3BK; 3PY; VK5AW; VO1I; VO1J; VO4Y; VP2CD; VP6TR; VP6YB; VP9G; VP9R.

(14 Mc.)

W 1ADL; 1AKK; 1AMH; 1ANM; 1ANW; 1AWA; 1AXL; 1AXZ; 1BCP; 1CPR; 1CFC; 1FAR; 1HUK; 1IBL; 1IPS; 1ISH; 1JJ; 1JJB; 1LQ; 1LQJ; 1LQW; 1PLW; 1QTW; 2ANR; 2BCK; 2BCF; 2CHQ; 2CF; 2ELL; 2GGM; 2TGM; 3EPV; 3FGI; 3FUF; 3MD; 3QH; 8BJX; 8DFH; 8GGC; 8IKH; 8MZE; 8OPB; CN8MA; CN8MB; CTLDT; CTLOM; CTLPC; CTLQQ; D 3BFN; 3BTN; 3DLC; 3LUK; 3XWK; 3YUR; 4AJJ; 4CSA; 4DHG; 4DLY; 4DVJ; 4FHK; 4JTK; 4KHY; 4KMG; 4MHV; 4MOD; 4OYT; 4QNM; 4TDH; 4TKX; 4UAA; 4ULD; 4UVD; 4WLL; 4WTK; 4YBF; 4YUM; EI5B; EI5R; EI71; EI8G; EI8J; EI8M; EI9F; ES2C. F 8AR; 8DC; 8DI ;8E B; 8FK; 8NC; 8NF; 8NR; 8NY; 8PX; 8PZ; 8RC; 8TX — FA3AY; FA8CR; FA8DA; FA8QT — G 2AT; 2DL; 2FA; 2GR; 2HV; 2JX; 2KL; 2LA; 2NG; 2NM; 2NS; 2OL; 2QY; 2TH; 2YY — G 5AA; 5AR; 5AT; 5CH; 5GL; 5GQ; 5HS; 5KA; 5MU; 5NM; 5OF; 5RF; 5UR; 5YH — G 6AV; 6BM; 6QQ; 6TB; 6UQ; 6UP; 6WN; 6XI; 6XP; 6XX; 6YU; 6ZM; 6CR; 6DP; 6JQ; 6KU; 6LA; 6LG; 6NU; 6NX; 6PJ; 6PK; GI6TK; GI6XS; HAF5C; HB9AC; HB9BX; HB9M; HB9X; HB9XX; I1AR; I1TKM; I1XC; LA1HL; LA2Q; LA3A; LA3P; LA5K; LA5L; LA5P; LA6U; OA1OK; OE3FL; OE6DK; OH2NO; OH2OH; OH6NI; OH6NO — OK 1DX; 1FZ; 1KX; 1MX; 1WF; 1XA; 2FA; 2HJ; 2OM; 2OP; 3CF — ON 4BD; 4BN; 4DM; 4FK; 4FQ; 4JJ; 4TF; 4UF; 4UT; 4VV; 4VW; 4VZ; 4WX; 4ZY. — OZ 1LF; 1NW; 2B; 2F; 2M; 2XA; 2Y; 3FL; 3Q; 4LM; 5G; I5LM; 5M; 5P; 5R; 7ON; 7P; 7PH; 7SH; 8A; 8J; 8R; 8T; 9Q — PA 0AM; 0DS; 0GA; 0GN; 0KN; 0KV; 0LR; 0MG; 0MU; 0NW — PY 1AF; 1DS; 1FF; 1KI; 1XV; 2AJ; 2CM; 2DN; 2EC; 2EJ; 4AP; 4AQ; SM3XJ; SM5PG; SM5QU; SM5UL; SM5VW; SM7UG; SM7XF; SM7YE; SP1BC; SP1CM; SP1FU; SP1LM; SP1TB; SP1TR; VK2AS; VK2VG; VO3O; VP2CD; YR5CF; YR5HC; YR5UU; YT7KJ.

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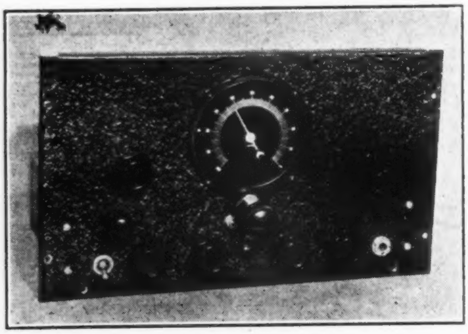
On April 20, 1930, W9FNK, operating a single 210 with 20 watts of raw a.c. input and an antenna 20 feet off the ground, was QSO with W9DJK (the only station he was able to contact in ten calls on 80 meter c.w.) In spite of the difficulty he had in raising anyone, even nearby, W9FNK later received "heard" cards from Wanganui, New Zealand, and Vienna, Austria, notifying him that he was heard working W9DJK. For the benefit of the skeptics, we might add that the heard cards were seen by a member of the staff of RADIO, and the times checked with W9FNK's log.

◆

A good way to make some extra change: Talk your local veterinarians into having you build them up diathermy machines for treating distemper. Most pups get distemper some time during their "adolescence", and the mortality rate seems to be highest among the most valuable breeds. Doctors treating pups with diathermy report they now very seldom lose a pup. A pair of 35-T's, T-55's, 808's, HF-100's, etc. at 900 to 1000 volts is more than ample for all "purps" and the smaller breed dogs. More power will be required for St. Bernards, Great Danes, etc.

A Super Gainer that "Just Grew"

By Frank B. Hales, W1BBU



Front Panel of the Coil Switching Receiver

The coil switching arrangement in this receiver, the description of which follows, is the result of considering it too much trouble to change the plug-in coils in my Super Gainer Receiver in order to change bands. Although I normally work on only one band, on occasion I do like to see what is taking place on some of the other amateur bands. And, as long as I was going to rebuild the front end, it was decided to add an i.f. stage, a beat frequency oscillator, and some more audio.

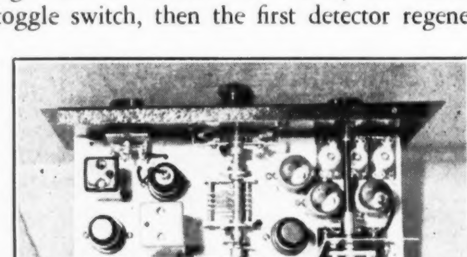
Exclusive of the coil switching arrangement, there is nothing new or different in this receiver circuit. The front end, it will be noted, is the same as the metal tube Super Gainer described in a previous issue of Radio and uses a 6L7 first detector and a 6C5 high frequency oscillator. The intermediate frequency stage is conventional and uses a pair of iron-core 456 kc. transformers and a 6K7 tube. The second detector is a 6C5 followed by a 6F5 first audio and a 6F6 second audio stage.

The beat frequency oscillator is a 6J7 connected in the improved b.f.o. circuit as described in the *Radio Handbook*. The b.f.o. coil itself is one-half of a midget i.f. transformer. The power supply and midget speaker are built into a cabinet salvaged from a midget b.c.l. receiver.

The coil switch used is the type commonly found in set analyzers and should be a good one with positive contacts (as I found out!). The switch shown is a five deck affair but only four decks are used. The coils are wound on 1" diameter by 2" long tubing with no. 21 s.c.c. wire. This is an odd size of wire but was the only kind available at the time. All data necessary for winding the coils is given in the accompanying coil chart.

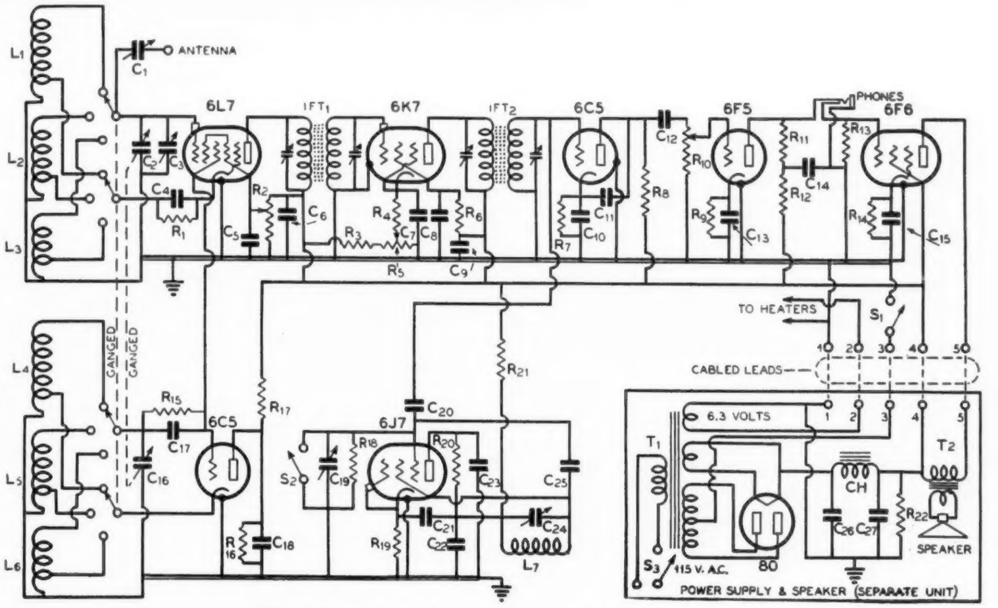
The main tuning condenser is a two gang affair consisting of two 35 μμfd. double spaced midgets connected together with a flexible coupling. The oscillator section has 2 stator plates and 1 rotor plate removed. The detector section has just 2 stator plates removed. This leaves an oscillator condenser of 8 plates and a detector condenser of 9 plates. The oscillator band-setting condensers are small 25-100 μμfd. padding condensers. To eliminate headaches it was thought best to use a midget 100 μμfd. variable condenser for the detector band-setting condenser. This eliminates tracking difficulties because if the coil turn spacing is varied slightly until the circuits track fairly closely, it is a simple matter to keep them in line with this condenser, which is operated from the front of the panel. It is an easy matter to set this condenser by ear for each band by tuning for the loudest hiss. The oscillator band-setting condensers, of course, are never touched once the bands are located on the dial.

In the photo of the front of the receiver the controls are as follows—reading from left to right on the bottom row: first, the stand-by toggle switch, then the first detector regenera-



Top View of the Superheterodyne

tion control, the i.f. gain control, the b.f.o. switch, audio gain control and phone jack. An airplane type dial is located in the center of the panel and controls the ganged band-spreading condensers. The shaft of this dial, to which the control knob is usually attached, has been



The General Wiring Diagram of the Receiver

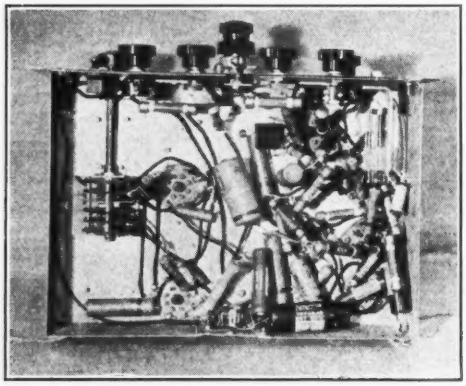
C_1—3-30 μμfd. midget trimmer
C_2—25 μμfd. midget. (Rebuilt 35 μμfd. double spaced midget)
C_3—100 μμfd. midget trimmer
C_4—.01 μfd. 400 volt
C_5—0.1 μfd. 400 volt
C_6,C_7,C_8,C_9—0.1 μfd. 400 volt
C_{10}—0.5 μfd. 400 volt
C_{11}—.001 μfd. mica
C_{12}—.01 μfd. 400 volt
C_{13}—5 μfd. 25 volt
C_{14}—0.5 μfd. 400 volt
C_{15}—10 μfd. 25 volt
C_{16}—20 μμfd. midget. (Rebuilt 35 μμfd. double spaced)
C_{17}—.0001 μfd. mica
C_{18}—.01 μfd. mica
C_{19}—20 μμfd. BFO coupling
C_{20}—1½″ twisted hookup wire
C_{21}—.01 μfd. 400 volt
C_{22}—0.1 μfd. 400 volt
C_{23}—.01 μfd. 400 volt
C_{24}—BFO trimmer condenser
C_{25}—.00025 μfd. mica
C_{26},C_{27}—16 μfd. 450 volt electrolytics
R_1—500 ohms, 1 watt
R_2—50,000 ohm regeneration pot.
R_3—75,000 ohms, 3 w.
R_4—400 ohms, 1 watt
R_5—5000 ohm i.f. gain control
R_6—100,000 ohms, 1 watt
R_7—50,000 ohms, 1 watt
R_8—100,000 ohms, 1 watt
R_9—5000 ohms, 1 watt
R_{10}—250,000 ohm audio gain
R_{11}—100,000 ohms, 1 watt
R_{12}—50,000 ohms, 1 watt
R_{13}—250,000 ohms, 1 watt
R_{14}—450 ohms, 10 w.
R_{15}—50,000 ohms, ½ watt
R_{16}—25,000 ohms, 1 watt
R_{17}—6000 ohms, 1 w.
R_{18}—50,000 ohms, ½ watt
R_{19}—2000 ohms, 1 w.
R_{20}—25,000 ohms, 1 watt
R_{21}—25,000 ohms, 1 watt
R_{22}—25,000 ohms, 10 watts
T_1—Power transformer, 700 v. c.t. 75 ma., 5 v. 2 a., 6.3 v. 2.5 a.

cut off to about ⅜″ long and a small planetary gear drive has been fastened to it. This makes a dual speed dial, the fast speed having a ratio of about 7-1 and the slow speed about 50-1 in 180 degrees. On the left side of the dial is a small knob controlling the detector band-setting condenser. To the right of the dial is the knob controlling the b.f.o. vernier. Just above the stand-by toggle switch is the knob of the coil switch.

Looking down into the receiver we see the detector and oscillator coils grouped about their respective sections of the coil switch. The three oscillator band-setting condensers are in a row at the lower left. The detector 100 μμfd. band-setting condenser is mounted on an aluminum shield that has been placed between the oscillator and detector coils and which extends to the right so as to separate the two sections of the ganged condenser. The ganged band-spreading condenser occupies the center of the chassis. To the left of this condenser is the intermediate frequency tube and transformers, with the second detector and audio tubes at the extreme right. The BFO coil and tubes are at the lower right toward the front of the receiver. The 3-30 μμfd. antenna coupling condenser can be seen at the upper left of the chassis.

The under side of the chassis looks like a first class service-man's nightmare, but it can be seen that very little hook-up wire is used, most of the wiring being done with the pigtailed connections of the various resistors and condensers. Power connections are brought in to a socket at the rear.

The receiver is built into a 7″x12″x8″ black crackle finish metal cabinet with a 7¾″x11″ x 2½″ aluminum chassis. With the tuning condensers specified, the 14 Mc. band covers 20 divisions of a 100 division dial. This is the reason for the planetary gear drive being added to the regular dial. If small band spreading condensers are used, the 14 Mc. band will be spread out over more of the dial, but then it will not be possible to cover the 3.5 Mc. band



Sub-Chassis View, Showing Layout of Parts

with one setting of the oscillator and detector band-setting condensers. As it is, I had to decide whether I wanted to listen to 75 meter phone or not, because the 3.5 Mc. c.w. band covers 95 divisions of the dial. The 7 Mc. band covers 45 divisions. For the c.w. man, like myself, skipping the 75 meter phone band is no hardship.

No extravagant claims are made as to performance. The receiver is simply an ordinary amateur superhet in the lower price class. Sensitivity and selectivity are good and, all in all, it seems to warrant its existence, if for nothing else than the band switching arrangement. After the receiver was built it was found that the first detector and oscillator tracked so closely that it was seldom necessary to touch the detector trimmer condenser.

The coil switching arrangement could be used for 10, 20, and 40 meters by using smaller band spreading condensers so as to get more band spread. If used for 40, 80, and 160, larger band spread condensers would be necessary.

Diagram Omission

25-100 μμfd. trimmers should be placed across L_1, L_5, and L_6 (compression type).

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Crystal Mike Amplifier

[*Continued from Page 37*]

The Microphone

The mike should be secured without stand but with the standard swivel ball screwed into its case at the back. If the swivel assembly is complete, remove the pipe fitting, spring and jointing cap. Discard the first two items and then drill out the hole in an Amphenol standard three prong male mike plug until the mike swivel ball will fit down in sufficiently far to permit plenty of swivel action (ball and socket) with the jointing cap replaced over the ball and screwed down (threads and size will match) over the plug. We now have a very efficient plug-in mike assembly suggesting installation right on the cabinet front panel. Up and down or right and left positioning of the mike face can be had at will.

Output Changes

Circumstances may at times be such that the individual user of a preamplifier such as this one will not want nor require pentode output into the line. Especially is this true if he has a good speech amplifier stage at the transmitter feeding a single or push-pull driver in turn feeding perhaps a class B modulator stage. He must, of course, then determine just how much power he will require of the mike unit and make such changes for V_3 as will limit the output to the desired value. In some cases triode connection for the 6F6 will be advisable. In others, a second 6C5 or perhaps a 6N7 with sections paralleled will be suitable. The individual builder will have to decide for himself just what changes he wants as regards the second tube and what circuit rearrangements would be necessary.

If the preamplifier is to be used directly to grid- or suppressor-modulate a low powered phone, pentode output will be found desirable. A change in the output transformer would be imperative, with a resistor perhaps across the output winding to stabilize the load.

Band	*Detector Coil*	*Oscillator Coil*
14 mc.	9 turns No. 21 scc spaced to occupy 1". Tap at 1/3 turn from ground end.	9 turns No. 21 scc spaced to occupy 1". Tap at 2 turns from ground end.
7 mc.	16 turns No. 21 scc spaced to occupy 1¼". Tap at ¾ turns from ground end.	15 turns No. 21 scc spaced to occupy 1⅛". Tap at 4½ turns from ground end.
3.5 mc. CW	37 turns No. 21 scc spaced to occupy 1⅜". Tap at 1 turn from ground end.	32 turns No. 21 scc spaced to occupy 1⅜". Tap at 10 turns from ground end.

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If you require a time clock that will handle more than 100 watts or so (the maximum that the ones designed to work a radio receiver will handle), one of the new "diathermy clocks" will do the trick. They will handle from 500 watts to a kilowatt, and the contacts may be operated upon either to open or close at a predetermined time.

Tommy Was a Ham

As Told to RUFUS P. TURNER, W1AY

When our boy arrived, so suddenly it seemed, at that awkward age when the beard sprouts like the first downy grass of Spring and a deepening voice clings furtively to remnant falsetto overtones, we became apprehensive lest he should take the well-known sudden interest in neck washing and hair oiling and so neglect affairs of graver importance to himself. But soon, his father and I wished that there had been an affair of love instead of the inanimate mess of wires and trappings that stole our Tommy's heart and head away. Instead of a bag of bones and hank of hair, his inamorata was radio, and she is a jealous mistress.

Radio, at the time, was assuming the proportions of a public craze, and Tommy began to find out what makes the wheels go 'round at the hands of a shop teacher. He took to books as we had never seen the likes of before. Then he began spending long evening hours building up curious mechanisms resplendent with shiny screws; and straightway, after the manner of his kind, he would pull them down again. He could exhaust a week's allowance in a single hour, then beg and borrow our purses empty. The vocabulary he acquired put his father to shame.

I have never before nor since encountered any hobby which so completely claims the souls of its adherents. Tommy Senior was never able to lose himself to such an extent in his golf, nor I in my bridge or books. Puppy love will peter itself out in time, but this radio hobby our son acquired made deeper inroads as time wore on. Its progress was rapid from pastime to appetite and finally to habit. As I pass back through the corridors of time, my truant fancy rebuilds the picture of him sprawling in all his lanky adolescence long hours before the object of his affection, impervious to all else (even to the cookie jar of his erstwhile delight).

Still, we did not complain. Tommy was at home. No longer did dinner chill while he pitched an extra home-run. It was good to have him inside out of mischief, what with young snips on every corner with naught to do but appraise the geography of every feminine passer-by.

The sending set which our boy built with the aid of multitudinous magazines and encyclopedias afforded him conversations with many a distant point; aye, with every place east of Suez. Running it seemed to exhilarate his every fiber. He showed it off to us one night in due course with much gusto, and we were amazed and displayed much pride in the ingenuity of our first-born. But we were fearful that the monastic existence he had taken up would transform him into one of those mental types. Ethereal contacts were fast replacing real flesh and blood people in his life; except for the few similarly afflicted creatures of every age, all with the same peculiar glint of eye and sallow jowls, who trekked in endless procession to and from his attic station. True, he did not neglect his studies, but we did not want him to become too deeply engrossed in this radio business. We had designs for his future. He was to follow in his Dad's architectural footsteps.

Fate, however, does not often decree that we shall chart without opposition the course of our children's lives. Daily our boy grew farther from the career we had planned for him, daily closer to radio. Before high school was over, he had already won many cherished laurels as a radio operator, and these evoked more pride on his part than his number-one standing in the graduating class. As to his future vocation, there was no question in his mind. His father was keenly disappointed and was adamant in refusing money for college unless it was for architecture. Tommy made his decision quickly. He set out to a distant city, there to prosper in the then embryo industry and to gain an education on his own hook.

In the years that followed, he annexed the engineering degree, attained early prominence in his chosen field, and has risen steadily. His judgment and ability are now of such wide repute that his associates in art in many a far-flung locale solicit his aid. He has kept himself gainfully occupied ever since he left the home roost; but for all his utilitarian hustle and bustle, his ardor for the thing that started him on his journey has never grown

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Semi-Automatic Transmitter Control with Relays

By CHARLES FELSTEAD,* W6CU

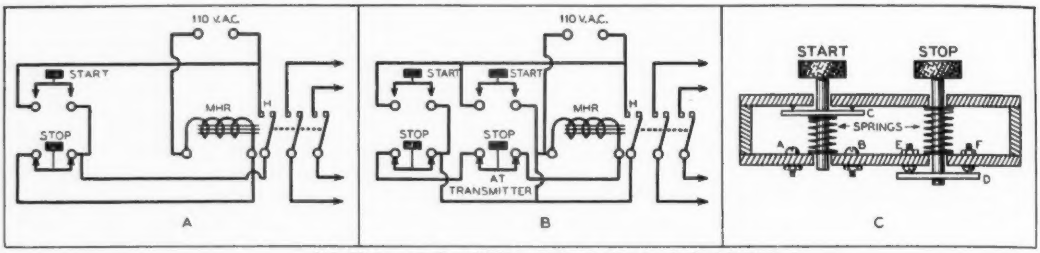

FIGURE 1 THE MASTER HOLDING RELAY AND CONTROLS

When building transmitting equipment, most radio amateurs are concerned only with obtaining maximum power output for the money to be invested. A second consideration, when it enters into their plans, is to build a transmitter that is neat and professional in appearance. But it is seldom that the amateur considers making his station simple to control and fool-proof in operation. Since amateur operating is a hobby, every effort should be exerted to make it as pleasant a hobby as possible. With that thought in mind, this semi-automatic control system was developed for use at W6CU.

Many amateur stations are controlled somewhat after this fashion: the operator plugs a cord into a wall socket, scuttles under the desk and closes a switch on the receiver power supply; then his hand finds a knife switch located in some awkward place, and the closing of that switch lights the filaments of the transmitting tubes. After the interval of thirty seconds (if he doesn't forget to wait) that is required to protect the mercury-vapor rectifier tubes, he closes another switch that applies plate potential to the transmitter. Turning off the transmitter requires that all the foregoing be done in reversed order.

Relay Control for the Transmitter

Contrast that with the operation of a fully relay-controlled transmitter. The closing of a master switch on the transmitter panel turns on the receiver and monitor, places voltage on the transmitter bus, and lights a yellow signal light. Two *start-stop* push-button switches are located beside the transmitting key on the operating desk. Touching the filament *start* button causes a holding relay to close, which turns on the rectifier and transmitter tube filaments and illuminates a green signal light on the control panel.

After the correct time interval, another relay closes automatically, flashing on a blue signal light to indicate that the transmitter is ready for operation. Touching the plate *start* button then causes a red signal to light and turns on the plate power supply of the transmitter. The plate power supply may be controlled during transmission by this second *start-stop* switch without disturbing the remainder of the system. Touching the filament *stop* button cuts off both the filament and plate supply of the transmitter and resets the time-delay element.

As just explained, after the filament *start* button is pressed and the correct time interval has passed, the blue signal lights, indicating that the plate power supply may be turned on whenever desired by the operator; but, as an alternative procedure, when the filament *start* button is pressed the plate *start* button may be touched a moment later, and then when the time interval has passed, the plate supply will come on automatically with the lighting of the blue signal.

This control system is entirely interlocked so that each operation must take place in the correct order, and there is no possibility that the plate supply will be turned on before the filaments are lighted. Provision may easily be made for an overload relay, and for remote control of the relays.

The Master Holding Relay

The heart of this transmitter control is the master holding relay, designated MHR in the diagrams. This is a three-pole, single-throw, normally open relay. Like all the relays in this system, the coil is for operation on 110-volts a.c. The two main contact arms should each be capable of carrying at least twice the total current drawn by the transmitter; but the third, or

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holding contact arm (marked H in the diagrams) is required to carry only the current drawn by the relay winding.

In figure 1 at A is shown the basic control connection for this relay. The devices marked *start* and *stop* are the two push buttons designed especially for this purpose. The *start* button is arranged to make momentary contact when pressed; while the *stop* button normally makes contact between its two terminals, but when pressed momentarily breaks this connection.

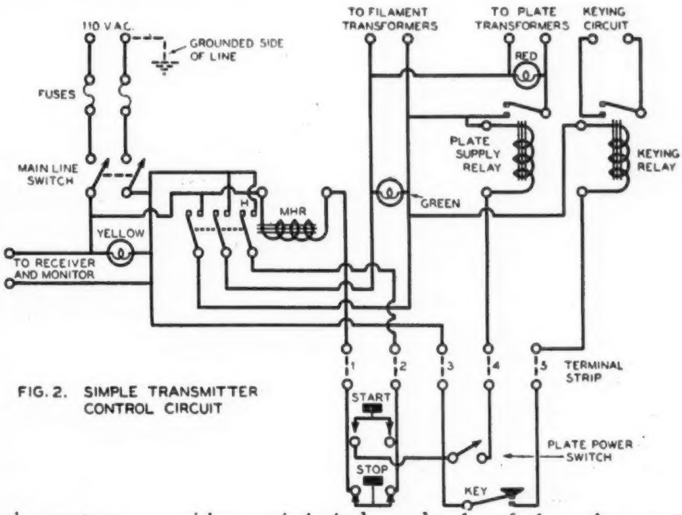
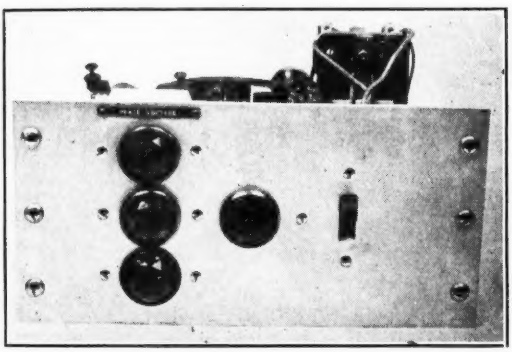


FIG. 2. SIMPLE TRANSMITTER CONTROL CIRCUIT

By tracing this circuit, it will be apparent that when the *start* button is pressed the relay winding is energized, causing it to attract the contact arms. This closes the three sets of contacts; and as the holding contacts (H) are shunted across the contacts of the *start* button, they continue the circuit through the relay winding after the *start* button is released.



Front View of the Control Panel

Since the contacts of the *stop* button are in series with the relay winding, pressing this button breaks the circuit long enough to allow the contact arms of the relay to be pulled back by the tension of the spring. This breaks the connection at the holding arm (H); so when the *stop* button is released and makes contact between its terminals again, the relay winding circuit is open and there is no action.

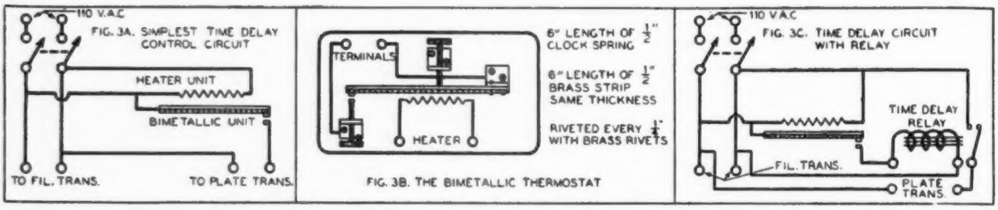
At B in figure 1 is shown the master holding relay circuit with an added *start-stop* switch. This additional switch, which requires three leads, may be installed at the transmitter in the power supply panel. Thus it is possible with this arrangement to control the MH relay by either switch independently of the other one, and so the transmitter may be turned on or off at either the transmitter panel or the operating desk.

These *start-stop* switches may be secured at any electrical supply house, or they may be constructed as shown at C in figure 1. The shaded portions should be of bakelite or other insulating material. Even masonite may be used. The metal plate C of the *start* switch is normally held away from the contacts A and B by the spring; while the metal plate D of the *stop* switch is normally held in contact with the terminals E and F.

A Practical Control Circuit

In figure 2 is shown a simple transmitter control circuit using the master holding relay with a single *start-stop* switch. The 110-volt a.c. line is connected through a fuse block and a main line switch to the two line contacts of the MH relay. This main line switch, which should be of the tumbler type, also applies voltage to the power supply for the receiving set and monitor and to a 110-volt signal light that is mounted behind a yellow bull's eye. The switch and three colored signal lights are mounted on the control panel at the transmitter.

The two main contact arms of the MH relay connect directly to the filament supply transformers in the transmitter. A signal lamp behind a green bull's eye gives indication when the filaments are on. Connected across this filament line, but with the contacts of a single-pole normally-open relay in series with them, are the transformers that supply plate power to the transmitter. A red signal light indicates



when this relay is closed and the plate power is on.

A terminal strip carrying five binding posts is located at the back of the relay control panel. A flexible cable connects these binding posts with the control equipment on the operating desk. One lead, the wire marked 3, is connected to one side of the 110-volt line and so is "hot"; but the other leads are safe to touch or ground because they are connected to the relay windings.

To reduce the danger of a ground on this "hot" lead causing a short-circuit on the line, and to eliminate any possibility of a shock from it, the number 3 "hot" lead is so connected that it is on the ground side of the 110-volt line, which places it at zero potential with respect to ground. The grounded side of the 110-volt line can be located by connecting a 15 or 25 watt lamp bulb to one side of the line and grounding the other terminal of the lamp. If the bulb does not light, it is connected to the grounded side of the line.

The plate supply control relay is operated by a push-button or tumbler switch of the type used in house lighting. This permits the plate supply of the transmitter to be turned off during reception without interrupting the filament supply circuit.

A standard telegraph or "bug" key controls the keying relay, which also is of the single-pole, normally-open type. If grid-block, filament center-tap, or oscillator keying is employed, this relay may have light contacts; but if the keying is in the primary circuit of the final amplifier plate supply, much heavier relay contacts will be required.

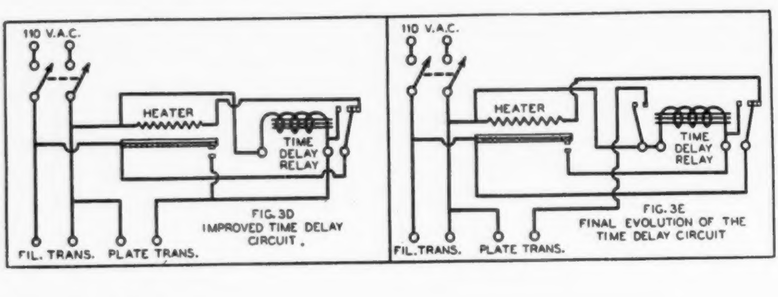
It may seem unnecessary to have both plate circuit and keying relays when primary keying is employed. But since the keying relay controls only the plate supply of the high-power amplifier stage, the main plate circuit relay is required to break also the primary circuit to the oscillator and intermediate amplifier stages.

Time-Delay Control Circuits

When mercury-vapor tubes of the 866 type are used as rectifiers, a delay of thirty seconds to one minute is required to permit the filaments to rise to normal operating temperature before plate voltage is applied. To avoid having always to remember to introduce this delay, the automatic thermostatic time control illustrated in figure 3 is incorporated in the improved transmitter control equipment. In order to provide a number of possible time-delay control arrangements for the selection of the amateur, the four steps in the development of this circuit are shown.

The simplest form of this time-delay control is illustrated in figure 3A. This comprises only a bimetallic thermostat (which may be made by riveting together a three-inch length of clock spring and a strip of brass of the same dimensions as in figure 3B) and a heater unit. The bimetallic strip is securely fastened at one end and the other end is equipped with a contact which touches a stationary contact when the strip bends under the influence of heat from the heater unit.

Each of the time-delay circuits shown in figure 3 is an improvement over the preceding one. Figure 3C shows the circuit of 3A arranged with a relay so that the current drawn by the plate supply transformer does not flow through the bimetallic element, only the current taken by the relay winding passing through that element.



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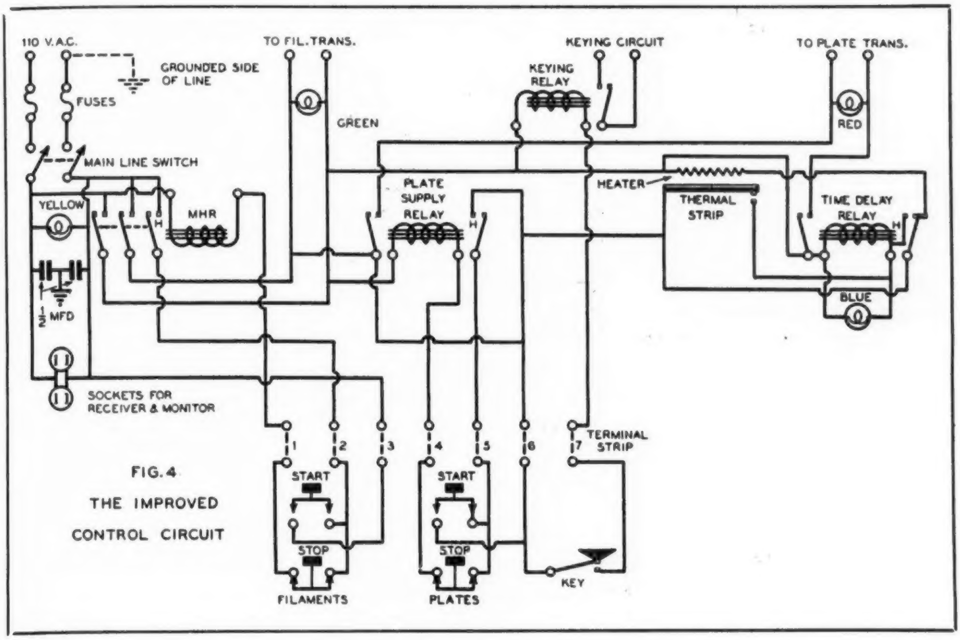
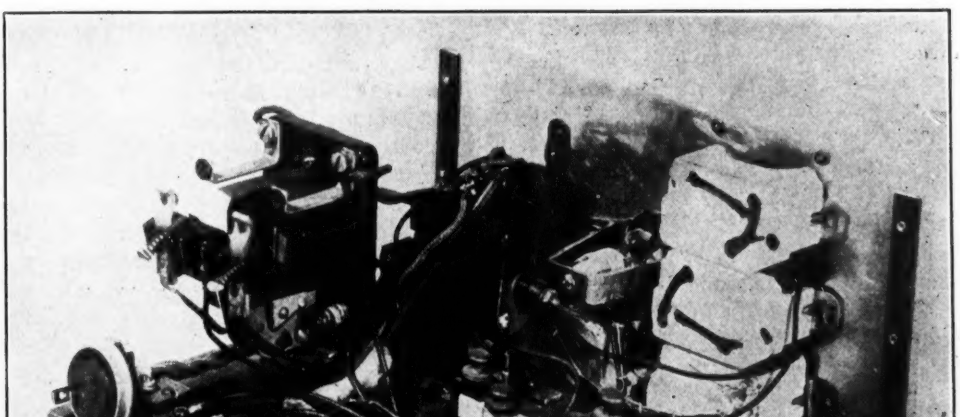


FIG. 4
THE IMPROVED
CONTROL CIRCUIT

Below: The Control Unit, Heart of the Automatic System



Push Button Antenna Directivity

By Ray L. Dawley,* W6DHG

Low angle radiation combined with either directivity in any desired direction or general coverage at the flick of a switch within the station! Presented herewith is a system of directing your signals electrically. The only mechanical thing about the whole system is the flipping of the relay armatures.

A multi-wire or long wire directional high frequency antenna has all the things to be desired of an antenna system except universality. The vertical angle can be controlled so that the major lobe falls in that comparatively narrow but highly desirable range of from 10 to 20°, and the horizontal layout can be made so that the major horizontal lobe is headed for Europe, Asia, or South America as the case may be. Thus we have a perfect antenna system for radiation in one or possibly two quite definite directions. However, if by any chance you should desire to contact any station off to the side of your beam, your chances of a satisfactory contact are very poor. This is the problem introduced by the majority of present beam antennas. The solution to this is either a multiplicity of beams to cover all the horizontal angles; a rotatable affair; or a fixed beam of which the radiation pattern can be changed from within the shack. The first solution is out of the question for any but a very small minority of the amateurs. Compact rotatable beams, following the recent developments of Smith and others, have become much more practical. They still, however, are impractical for any but the higher frequencies and they do require an undue amount of mechanical work before they can be rotated from within the shack.

It was then to the last solution, a directional beam whose horizontal angle could be changed *electrically,* that the author turned. The resulting system to be described in this article is small enough to be placed on the roof of an ordinary house for the 14 Mc. and higher bands, is sharp enough so that it gives a power gain of from 5 to 8 db. in its favored directions, and is instantly rotatable by means of a switch within the station so that its major lobes cover 360°. Also its vertical pattern is such that the majority of the radiation lies in the useful lower angles. Another very useful feature of the system is that it can very well be placed upon a hill-top some distance from the operating position and be controlled from the receiving position. The complete system is shown in the diagram of figure 1. The transmission line from the shack to the antenna system is of no. 10 wire spaced 6″ on spreaders designed for that purpose. Each of the individual "Q" type matching sections from the switching box at the center to each half wave antenna is of 1/4″ copper tubing wired to the *outside* of Johnson type 132 two inch spreaders. These sections are exactly 1/4 wavelength long as in the conventional Q arrangement. The spacing between the outside ends of each 1/2 wave antenna is 1/2 wavelength. However, due to the fact that the distance from the center of each antenna to the control box is slightly more than 1/4 wavelength, the Q matching sections will have to be pulled in toward the center. This is shown graphically in the side view of the system.

In the diagram showing the ten meter array being supported from a single pole, each of the cross arms coming from the pole to support the ends of the individual antennas is 1.15 times 1/4 wavelength or in this case about 9.5 feet long. You can prove this to yourself if you set up an equilateral triangle such as the one in which the antennas are arranged and calculate the distance from one of the apexes to the center.

Each of the three Q sections from the individual antennas is brought to three sets of feed-through insulators in the sides of the switching box. In this box are two d.p.d.t. 110 volt a.c. operated relays designed for antenna or feeder switching. These relays are connected to the various Q sections and to the transmission line from the transmitter as shown in the relay diagram. A three wire line of heavily insulated rubber lampcord is used to carry the 110 a.c. that operates the switching relays.

With both relays in the non-operated condition the matching sections are connected as in A of figure 3 and the space pattern shown alongside is obtained. The relays and the antenna system itself should be oriented in such a manner that with the relays non-operated the system will radiate in the direction most frequently used. This, of course, will save wear and tear on the switching relays. It will be seen

*Technical Editor, Radio.

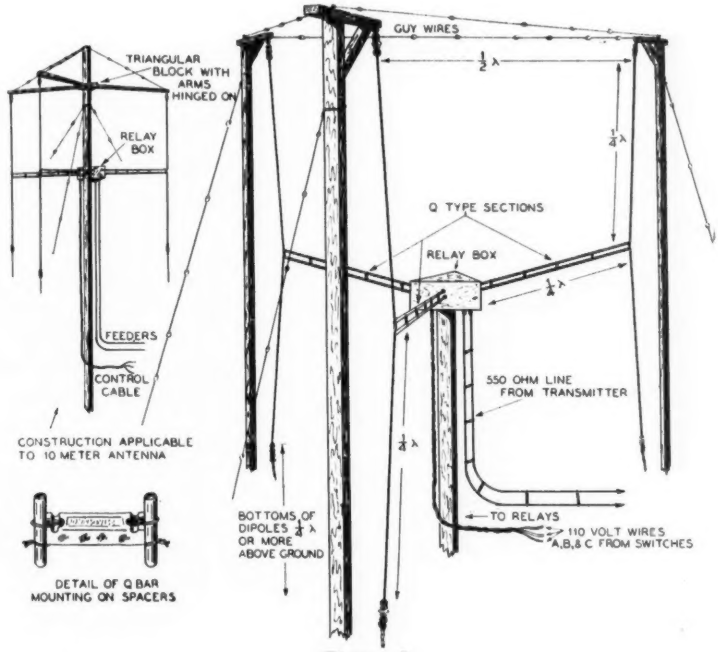


Figure 1
The Complete System, Showing Two Methods of Support.

that in this case antenna 2 has its feeders reversed with respect to the other two. Consequently the direction of favored radiation lies in a plane through antenna 2 and the center of the system.

With S_1 closed, relay K_1 is operated and the conditions shown in B of figure 3 are obtained. When relay K_1 closes, the polarity of the feeders of antenna 1 is reversed. Thus both antennas 1 and 2 are reversed in polarity with respect to antenna 3, which is directly connected to the transmission line going to the transmitter. Now our radiation pattern passes through a plane that intersects the antenna that is reversed with respect to the other two (antenna 3) and the center of the system. The pattern is shown graphically to the right of B.

Now, if we close S_2 in addition to S_1, we obtain the connections and conditions shown in C of the same figure. Antenna 1 is still reversed in polarity with respect to antenna 3 but antenna 2 has now been reversed in polarity so that it is *in* phase with antenna 3. Now antenna 1 is out of phase with the rest so that the radiation pattern now goes through this antenna and the center. This pattern is shown to the right of C. Complete 360° coverage is obtained by the antenna as will be seen by superimposing the space diagrams of A, B, and C upon each other.

In each case it will be noticed that the radiation pattern of the system passes through the radiator that is out of phase with the other two and through the center of the system. Now, if we close only S_2, relay K_2 will close and we have an entirely different situation. In this case all three of the antennas are being fed in phase with each other. The result is quite interesting. The system now becomes non-directional but it has quite a low angle of radiation due to the interaction of the various elements. Thus, with the switch in this position, we have the system set up for very good dx coverage in all directions but *no* directivity.

The two switches S_1 and S_2 can best be placed alongside the transmitter power switch so that the direction of radiation can instantly be changed to point at a station it is desired to contact. Of course it must be remembered that when you leave the shack and pull the main power switch, the a.c. that goes to the switching relays should be disconnected also. This of

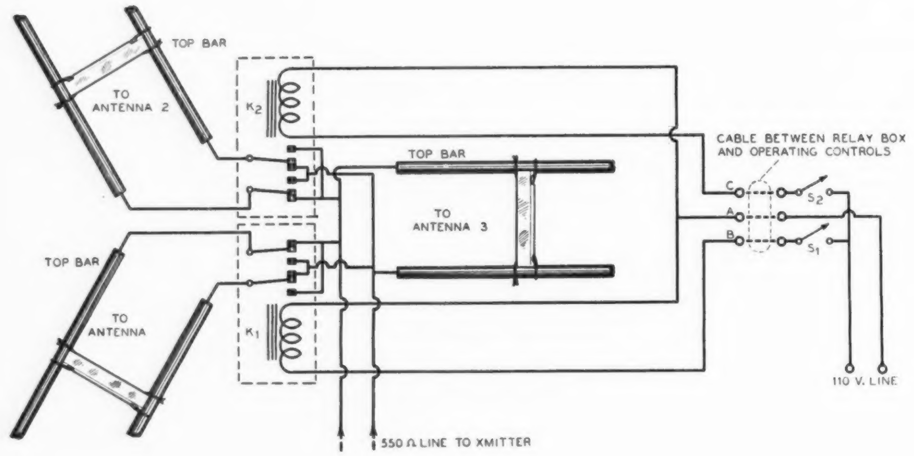


Figure 2
Detail of Relay Connections and Control Switch.

course can be easily accomplished by obtaining the 110 a.c. for the switching relays from the primary of the receiver power pack or from a similar place that is cut off the line when the main power is disconnected.

Another worthwhile suggestion would be to place another d.p.d.t. a.c. operated relay in the 550 ohm line to the antenna system and to connect it so that when the transmitter is not on the air the antenna will be connected to the receiver. In this way the directional properties of the antenna would be very helpful in reducing off-side interference to reception. In addition the antenna will give a gain when it is phased so that it is directional toward the station being received.

Mechanical Construction

Two diagrams are given, one for a 14 Mc. array and one for 28 Mc., and different types of construction are used in each.

The 14 Mc. system is supported from three 45 to 60 foot poles for the individual antennas and one 30 to 45 foot pole to hold up the switching box. The three longer poles are arranged in an equilateral triangle ½ wavelength on a side and the shorter pole is placed at the exact center or the intersection of the medians of the triangle. The system can be guyed as indicated in the diagram. Another pair of side guys from one of the poles may help to improve the stability of the arrangement. It is important that both the 550 ohm transmission line and the three-wire 110 volt a.c. line come directly down the pole toward the ground until they are somewhat below the bottoms of the antennae before they are bent to come toward the shack.

Alongside the 14 Mc. array diagram is shown the method of wiring the ¼" copper tubes to the type 132 spreaders, and on the left a small diagram of a suggestion for a 28 Mc. array to be supported by a single pole. The individual cross arms that support the ½ wave dipoles are each attached by a hinge (see W6LEN rotatable array, page 16, May Radio) to a triangular block that is nailed to the pole. The relay box can be supported on one side of the pole with enough of an offset so that the Q-bars from the opposite side of the pole can enter without difficulty.

The triangular box that contains the relays can well be made of ¼" Masonite, air tight, well impregnated with shellac, and varnished all over with a good grade of weather-proof insulating varnish.

Care must be taken to see that all guys, especially those paralleling the antennas, are well broken with egg-type strain insulators.

Should the system be used on a lower frequency than 14 Mc. it will undoubtedly be necessary to support the centers of the Q matching sections. This can be done by means of guy wires (very well broken up) from the top of the system down to the bars.

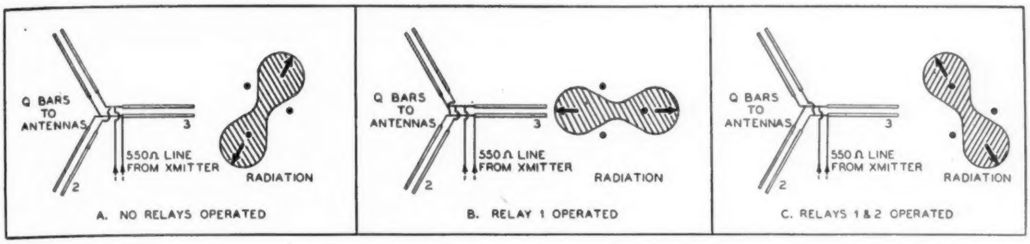


Figure 3: Directivity Patterns with Three Different Combinations of Relay Positions.

Theoretical Considerations

To those interested in the design of the system, a discussion of the description will be given. This may also be of some assistance to anyone who may desire to make elaborations upon the arrangement as it is given here.

First, the operation depends upon the fact that when two half-wave antennas, ½ wave apart, are excited in phase the radiation pattern passes broadside (perpendicular) to the plane in which the antennas lie. Also upon the fact that when another ½ wave antenna is placed ½ wave back of the other two and excited *out* of phase with these two, the vertical angle is further lowered and this last antenna tends to concentrate the horizontal radiation in the same direction as determined by the former two. It will be seen that in each case (A, B, and C) this is what we have. So by changing the phasing of these three symmetrically placed antennas we can obtain bi-directional radiation in three horizontal directions each 120° apart. However as each of the six lobes are from 50 to 70° wide before there is much attenuation, we obtain good 360° coverage.

We obtain the different phasing of the three antennas by changing the polarity of the three Q-type matching sections that feed them. The design of these three sections differs somewhat from conventional practice. In the first place, since we are going to use a 550 ohm line (no. 10 wire spaced 6″) from the transmitter to the antenna, and since we must parallel three of these matching sections at the switching box, the resultant impedance obtained by paralleling these three sections must of course be 550 ohms. So, the impedance of each of these three sections must be three times 550 ohms or 1650 ohms.

The center impedance of each of the three antennas will be lowered somewhat by their mutual reaction. If we take the average center impedance of the three doublets as 71.1 ohms (an approximation) we see that our Q-section must match this impedance to 1650 ohms. Now, the impedance of a ¼ wave matching section must be the geometric mean between the two impedances it is designed to match.

Consequently: $Z_q = \sqrt{71.1\ (1650)} = 343$ ohms.

We see that our Q-section impedance must be 343 ohms. If we wire ¼″ copper tubing to the outside grooves of Johnson type 132 spreaders, we obtain a center to center spacing of the conductors of 2 3/16″ or 2.1875″. This spacing is slightly more than the 2″ length of the insulators.

Substituting these two values in the formula for transmission line impedance:

$$Z_s = 276 \log_{10} \frac{S}{r} = 276 \log_{10} \frac{2.1875}{0.125} = 343 \text{ ohms}$$

So we see that ¼″ copper tubing spaced this amount gives us the correct surge impedance. Thus our impedances are matched throughout.

The Practical Development

The preliminary developments were made and the radiation patterns of the system checked on the 112 Mc. band. In this way the whole system was so small that changes in the dimensions were very easily made. The first experimental model was entirely hung from a badminton net that had been doubled back upon itself. The net was suspended about 8 feet above ground so that it was possible by stand-

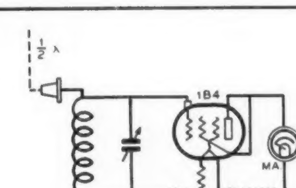


Figure 4
The Field Strength Meter

ing on a chair to make any adjustments or changes in the arrangement.

The oscillator used to excite the system was conventional and used a pair of WE-316A "mud turtles" in a t.p.t.g. push-pull circuit with about 400 volts on their plates. These little tubes operate as well on 112 Mc. as most so-called high frequency tubes do on 7 Mc.; so no difficulty was had in obtaining sufficient r.f. to make good field measurements.

The field strength meter is a little out of the ordinary so it will be briefly described as an addenda. The tuning circuit consists of an MEX trimmer condenser shunted across two turns of no. 14 wire spaced to ½" and ½" in diameter. The tube is a 1B4 with the screen grid connected to the plate. The tube is biased to cut-off by the drop across the 16 ohm filament resistor and the 1½ volts of the last cell of the C battery that supplies the filament power. A 22½ volt battery connected in series with the meter supplies the plate voltage. The unit is quite sensitive; good deflections were obtained some distance from the antenna system.

◆

Relay Control

[Continued from Page 54]

Figure 3D is a greatly improved circuit. Here the heater unit is disconnected the moment the bimetallic strip makes contact and turns on the plate power supply. This allows the heater to cool off and permits the bimetallic unit to open its contacts, thus resetting itself for the next time the transmitter is turned on. The time-delay relay, however, continues to pass current to the plate transformers until the 110-volt line is opened by the plate circuit relay.

The advantage of circuit D is that if the main line is opened during operation and closed again in a few moments, the thermal strip is cold and the entire time interval must pass before plate voltage is applied to the 866 rectifiers, which may have cooled considerably during the interval while the switch was open. This offers an element of protection that is not present in circuits A and C.

The only disadvantage of circuit D as compared with circuit E is that in circuit D the thermo-strip contacts must carry the full primary current of the plate transformers for an instant before the relay is energized. Although there is little possibility that this current will damage the strip or contacts, it is well to provide the additional relay contacts to take care of it.

The Improved Control Circuit

In figure 4 is shown the final evolution of this transmitter control circuit, which combines all the features so far discussed. It incorporates the time-delay circuit as well as an additional holding relay for the plate power supply. Two fixed condensers of equal size are connected in series across the 110-volt line and the center connection grounded. These condensers should have a voltage rating of at least 300 volts and a capacity of ½ microfarad or higher. They help to prevent electrical surges due to key clicks from being fed back into the power line and so to nearby broadcast receivers; and also they serve to by-pass any r.f. energy that may get into the control unit.

A seven-conductor cable, which may be of the type used for receiver power supplies since it carries but little current, is connected to the control switches at the operating position. The other end of this cable carries a male seven-point plug which plugs into a female connection mounted at the back of the relay control unit. A double outlet socket is provided beside this connection for the plugs of the receiver and monitor power supplies. Terminal strips provide for connection between the control panel and the filament and plate power supplies of the transmitter. A regular cord and plug permit the control panel to be plugged into the nearest 110-volt outlet.

This relay circuit provides an amazingly simple and flexible control for the transmitter that makes operating a joy and that lends a delightful neatness and orderliness to the transmitting desk. It definitely moves a station from the "ham" class to the amateur division.

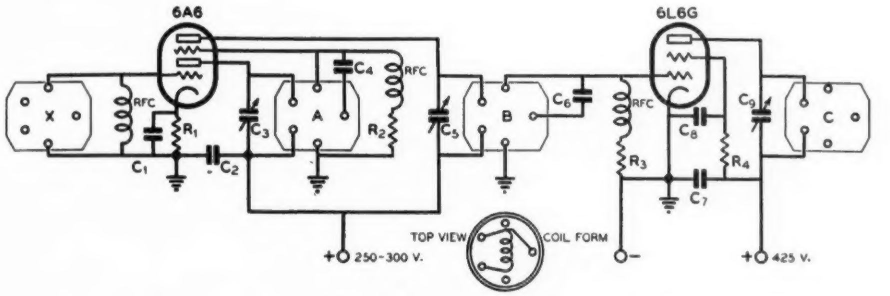
◆

QRM and Mobile Operation Legislation

A number of states are enacting legislation to penalize interference with radio reception and also for equipment of police authorities with radio. Vermont has enacted a radio interference statute with a $500 fine provision. Other interference statutes are pending in Michigan, Nebraska and Pennsylvania.

Permits to operate automobiles containing short wave radio sets are required under a new statute of West Virginia which also provides for police radio equipment. Legislation for police radio equipment in New Jersey, Iowa, Virginia, Michigan, California and Wilmington, North Carolina, also is in process.

Simplifying Exciter Coil Requirements



C_1—.01 μfd. mica
C_2—.002 μfd. mica
C_3—100 μμfd. midget variable
C_4—50 μμd. mica

C_5—100 μμfd. midget variable
C_6—50 μμd. mica
C_7,C_8—.002 μfd. mica
C_9—100 μμfd. 1000 volt variable

R_1—400 ohms, 10 watts
R_2—25,000 ohms, 2 w.
R_3—50,000 ohms, 2 w.
R_4—30,000 ohms, 3 w.

RFC—2½ mh. 125 ma. choke
Coils — Appropriate values for band in use. All wired as in diagram.

Mr. Roy H. Raguse, W6FKZ, submits the following suggestion for the modernization of the old Jones 6A6 exciters. The same interchangeable coil and crystal idea as used in the Bi-Push exciter is employed.

The 6A6 part of the unit is the standard Jones exciter with the exception of the manner in which the plug-in coils and sockets are wired. The 6A6 is followed by a 6L6G with appropriate plate voltage. This last tube ordinarily acts as a doubler when being excited by the 6A6. However, when fundamental output is desired from the crystal, the grid coil is removed and the crystal is inserted in the grid circuit of the last tube. In this way 20-30 watts of output power is available on the fundamental frequency and its second and fourth harmonic. Thus with a 7 Mc. crystal, output is available on the 7, 14, and 28 Mc. bands. With a 1.75 Mc. crystal, output is available on 1.75, 3.5, and 7 Mc.

Operation is very foolproof; it is only necessary to plug the crystal in the proper socket and to place the appropriate coils in the following sockets for operation on any band. One important feature of the unit is the fact that all the coils are wired exactly the same. Thus the 7 Mc. coil can be used either as an oscillator or a doubler coil as the case may be. Incidentally, only the tubes being used at the time have plate voltage upon them. When a coil is removed from the plate circuit of one of the tubes the plate voltage is automatically disconnected.

COIL POSITIONS FOR OPERATION WITH 3.5 MC. CRYSTAL

Frequency	*Crystal*	*3.5 Mc. Coil*	*7 Mc. Coil*	*14 Mc. Coil*
3.5 Mc.	"B"	"C"		
7 Mc.	"A"	"B"	"C"	
14 Mc.	"X"	"A"	"B"	"C"

COIL POSITIONS FOR OPERATION WITH 7 MC. CRYSTAL

Frequency	*Crystal*	*7 Mc. Coil*	*14 Mc. Coil*	*28 Mc. Coil*
7 Mc.	"B"	"C"		
14 Mc.	"A"	"B"	"C"	
28 Mc.	"X"	"A"	"B"	"C"

To aid in showing how bands are changed, the following chart indicates where to plug the coils and crystal for operation on three bands with either a 3.5 or 7 Mc. crystal.

Coils can be wound on standard 1½" forms. The number of turns for any band can be found by reference to the Handbook or to any previous article on the old type exciter.

It will be noted by reference to the table that there is always a coil in socket C. This works out very nicely because it prevents the plate voltage being removed from the 6L6 while the screen voltage is still applied (ordinarily damaging to the screen).

◆

Tommy Was a Ham

[*Continued from Page 51*]

cold. Radiograms brought to us by boys who were crying in cradles when he was first bitten by the bug, disclose his continued interest in amateur radio. Not the least important of it all, Tommy has, by keeping abreast of the rapid strides made by radio, maintained a youthful point of view.

* * *

At home, the picture has been vastly different. Dad's prosperity faded into thin air during those hectic years between twenty-nine and thirty-one. He lost all—hope and bright outlook to boot—and has gained only faithlessness and an acrid disposition. With business gone and life reverted to chasing the eight-fifteen in the morning, he finds complete diversion in nothing. The other day, he drew himself up to admitting his envy of Tommy's absorption in his hobby. I had to draw myself up to tell him something too—that Tommy's cloister had at last, wonder of wonders, been invaded by another mortal intent to usurp a piece of his devotion. She is a blithesome sprite with blue eyes and golden hair, and next week she is to become a permanent part of his design. It leaves us both wondering how he was interrupted long enough to tune her in!

◆

The Question Box

Can you tell me how I can cure a trouble I am having with my final plate supply? It seems to work perfectly up to about 200 ma. but as soon as this drain is exceeded everything goes haywire. One of the 66's goes out and the other one seems to take all the load, both chokes and the plate transformer groan unmercifully, and the carrier of my rig has a bad ripple on it. Since it seems to be in the filter, here are the values of the components: The input inductance is a 50-350 ma. swinging choke; this is followed by a 2 μfd. condenser, a 20 hy. filter choke, and a 4 μfd. condenser.

Undoubtedly your trouble is being caused by resonance in the filter system. More than likely, at about 200 ma. the inductance of your swinging choke is in the order of 4 henrys. This value of inductance will resonate with the 2 μfd. of capacity in the first condenser at the ripple frequency. When this takes place, the whole normal action of the power supply is upset and the results you speak of take place. It is very seldom that the following filter sections are found to resonate. Usually they just try, through their normal action, to correct the havoc wrought by the conditions in the first sections of the filter.

Since the resonant condition exists between the input choke and first condenser, if we appropriately change the values of these components the trouble will disappear. Either the value of the inductance or the capacity can be changed; preferably increased.

•

I have a power supply using a pair of 66-A's on 1000 volts. During the winter when it is very cold in the operating room I have great difficulty in getting the tubes into operation. In extremely cold weather I actually have to turn an electric heater on the tubes to keep them warm enough. Is this a characteristic of mercury vapor rectifiers or is there something I can do to clear up my trouble?

No, the condition you speak of is not necessarily a characteristic of mercury vapor rectifiers. It is, however, a characteristic of 66-A tubes when they are operated at such a comparatively low plate voltage in very cold weather. If you replace your 66-A tubes with 66's having no cathode shielding sleeve (practically all standard 66's are of this type) the tubes will start much easier under the adverse conditions you mention.

•

Can a push-push doubler be modulated? I am using one in the final stage of my transmitter. At present I am operating on c.w. but I would like to put the rig on phone. I understand that in a push-push doubler the tubes operate class C. If this is true it would seem that the amplifier could be modulated. Is my reasoning correct in this case?

Under the majority of conditions a push-push doubler can be plate modulated to give good audio quality. Certain conditions, however, must exist before linear modulation can take place. First, the two tubes used in the stage must be accurately matched both as to the electrical characteristics and as to the interelectrode capacities. The electrical balance must exist so as to cancel any fundamental output that may be produced. The interelectrode capacities must balance because each tube acts as the neutralizing condenser to the other.

Secondly, the tubes must have high bias and adequate excitation. These are primary requisites for any class C amplifier, but they are more stringent for a push-push doubler when it is to be operated as a class C modulated stage. This is true because even at peak modulation when the plate voltage is doubled, the operating angle of either of the doubler tubes must still be less than 90° as compared to a maximum angle of approximately 180° for a "straight through" class C amplifier on modulation peaks. This means that at no modulation the operating angle of each tube in the doubler must be somewhat *less* than 90°. Consequently, quite high plate currents must flow for extremely short periods of time in order to obtain any output.

Progress As You Prosper

By C. H. Humes, W9THL

Every ham who sets out to build a station immediately finds himself face to face with the problem of deciding which path he should choose to get a signal from his own weary brain to somebody else's antenna and vice versa. If he is to take full advantage of the many pleasures offered by ham radio, and at the same time avoid personal bankruptcy, his plans must be carefully laid, for the pit-falls are many and deep. More than one Ham has found his progress suddenly halted and his fun curtailed because his rig wouldn't go where the new fields beckoned. The grass always looks greener in the other fellow's pasture and the day will come when the band where you aren't is the place you long to be. Then woe to the unfortunate who can't get there without practically rebuilding—because just as sure as you get there you'll want to come back, and rebuilding transmitters is an awful blow to those vagrant whims and the urge to snoop that make Ham Radio the fun that it is today.

The greatest problem in amateur radio always has been to build a station that would take in as many amateur activities as possible, at the same time requiring a cash outlay smaller than the National debt. The latest offspring of these efforts and one which seems to fill the bill pretty well, is described herewith.

The initial survey of the situation brought out several self-evident facts. The rig, both transmitter and receiver, should be capable of operation on at least five bands, both c.w. and phone, with band-changing maneuvers reduced to a practical minimum, as to time and effort. Band changing, if any, on the average amateur rig is aptly described by the fellow who said he "quickly threw a couple of switches and changed a couple of coils—and twenty minutes later he was on another band".

Further, complete operation of the station should be controllable from the operating position. Personally, I am not athletically inclined and object to wearing a path on the shack floor just because space won't permit putting the transmitter within arm's reach. At the same time, front panel control of transmitter power is essential to avoid wearing the same path in the opposite direction during tuning procedures.

The rig should be adaptable to different antenna types as well as varying coupling methods. Almost every location presents its own antenna problems and I, for one, don't like to be caught short in case I want to change. Besides, I may not be able to pay my rent sometime, and may have to move to a new location!

And last, but not least, as prosperity gets farther around the corner, and the budget permits a little expansion from time to time, I want to be able to increase the size of the rig and my signal without having to throw away everything that has already accumulated and start all over again. In other words, the transmitter should

Figure 1
The "Progressive" 350 Watt Transmitter in Operation.

be capable of expansion by the simple process of "adding on".

"Progress As You Prosper"

This latter consideration brought on the idea of "progressive" transmitter building, the particular pet of Gerry Cole, Ex-9MR-9MK, whose

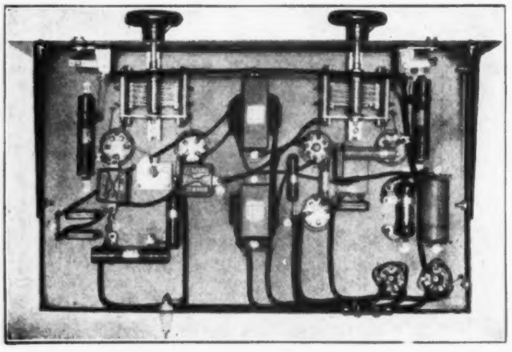


Figure 2
Under Chassis View of the Exciter

not-too-patient guinea pig the writer has been through the series of developments that have led to the present rig. The first "Progressive" was completed early in 1935 and employed tetrodes throughout the r.f. end, with the exception of a tri-tet oscillator. Shortly thereafter power pentodes in adequate sizes became available to the amateur, and Progressive II was born, with a lusty pair of 803's in the final, a beautiful job for those as likes pentodes. But pentodes are costly. In the meantime the vacuum tube manufacturers had been busy bringing out a series of inexpensive triodes especially designed for operation at the higher frequencies and capable of quite respectable outputs. The return to triodes was clearly indicated, and thus "Progressive" III, and the present station layout, came into being.

If you will recall the criteria originally established you will probably have realized by this time that they all point to just one thing—flexibility.

The station arrangement was designed to place every operating control within arm's reach of the operating position. The keys for c.w. are located immediately to the right of the receiver itself and well back on the table to provide a comfortable arm rest for long hours of traffic handling. Incidentally, if you are going to pound brass, this is an item not to be overlooked. After you've passed along a few thousand words at thirty per, with your elbow in the air, the good old right arm will appreciate a place to light.

The speech amplifier, with its gain controls, sits immediately to the left of the receiver, and the transmitter itself at the right of the operating table, with all meters clearly in view.

The field strength meter, perched on top of the receiver at eye level for easy reference, provides a continuous monitoring of the antenna output. The author has also found it useful for discovering just which of the house lighting circuits was absorbing most of the radiated energy!

The "world", sitting atop the speech amplifier and partially obscured by the Barrymore profile, is useful in locating great circle routes and in laying out directive antenna systems—which probably won't fit on the roof anyway. The mike, a Shure no. 70S, is provided with a nice long cable so that it can be conveniently passed around among the visiting Hams without necessitating two or three layers of people at the operating position.

So much for the operating set-up. The heart of the station, of course, is the transmitter itself and it is with love and tenderness that we turn the light of analysis on this, the ham industry's latest brain-child. There is an old song to the effect that "Every old crow thinks her babe am white as snow"—and a Ham is probably no different. So, if we sound unduly laudatory, think nothing of it.

At the outset of this literary enterprise there was considered a set of operating requirements for the station and it might be well to review them at this point in their relation to the transmitter proper. They may be stated briefly as follows:

1—Five band operation, with both phone and c.w. wherever the law allows.
2—Band changing with a minimum of effort.
3—Adequate antenna coupling provisions.
4—Standard parts—a minimum of "handwork".

For neatness and convenience, standard rack and panel construction was decided upon. A survey of the available low-cost triodes disclosed the possiblity of obtaining all that was wanted in the way of output and frequency multiplication in four stages, and the r.f. end thereupon began to take shape.

The R. F. Line-up

The newly arrived 6L6 beam tube looked intriguing and likely; so into the oscillator it went, as a straight tetrode oscillator, with fifteen watts available without mistreating the crystal. There's nothing in the world like starting a triode rig with a tetrode.

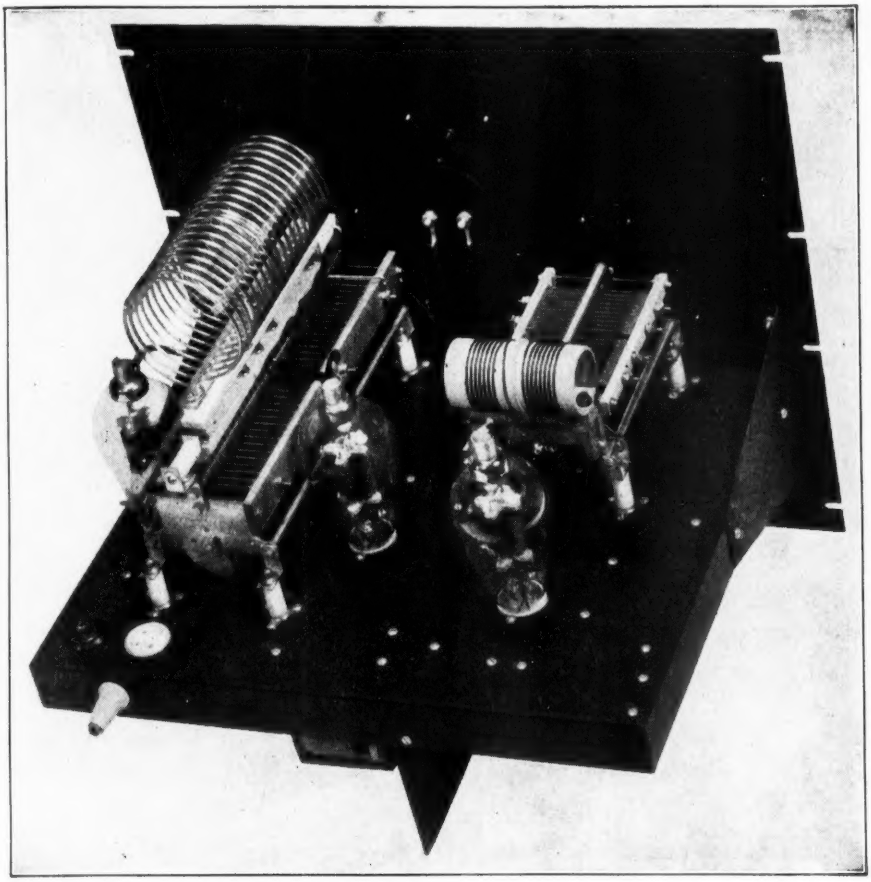


Figure 3: The T-55 Driver and 350 Watt Push Pull Output Stage

The choice of the succeeding stage was not so easy. The tube must be one which would multiply well on the output of the 6L6, and at the same time be willing to operate as a straight-through amplifier without insisting on its own frequency. The Taylor 756, with its low inter-electrode capacities and adequate output, was the bottle chosen. Capacity-coupled to the oscillator, and properly neutralized, the combination produced as neat an exciter unit as could be desired, capable of putting a respectable signal on the air in its own right, or of administering a sizeable kick to the grid of a following stage. A worms eye view of this exciter unit, with wiring in, is shown in figure 2. With the circuit constants shown, this exciter delivers an adequate output on any of the amateur bands from 1750 kc. to 28 Mc. The harmonic generation in the buffer stage is high, permitting the use of a minimum number of crystals in covering the bands. This harmonic output, by the way, includes some of the odd numbered ones; so frequency-multiplication must be carefully monitored during tuning operations to avoid landing on one of them, particularly the 3rd.

Note that the tank condensers are "underslung"; since all coil and tube connections terminate below the chassis, that is obviously the logical place to put them. It is significant that the half-inch leads resulting from this construction are among the vital factors in the success of satisfactory multi-band operation. If you don't believe this, try putting them top-sides, and see what happens to your 10 meter efficiency. Filament transformers, resistors and fixed condensers, as well as all wiring, are likewise below decks, leaving the upper surface of the chassis clear of everything except the plug-in elements.

With this beginning it is possible to develop the transmitter to practically any power desired,

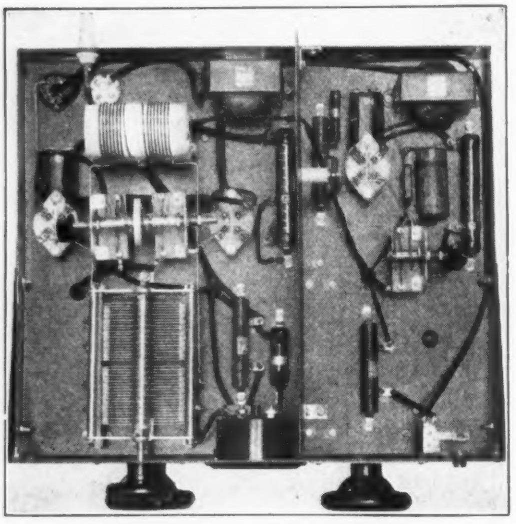


Figure 4: Under Chassis View of the Driver and Output Stages

simply by designing each following stage to deliver its full output from the excitation available. Electrically this is a simple matter. Mechanically it is not so simple, for in the mechanical layout and the careful choice of circuit components lies the secret of the stability and easy flexibility of multi-band operation.

The designer's choice for the next stage was the Taylor T-55, a high gain triode with plate lead out of the top and a plate-dissipation rating of 55 watts, to be used as a driver for the final stage employing a pair of the same. From this point on, the problem of design becomes acute and it is probably perfectly safe to say that the chances of successful operation of any transmitter, especially on the higher frequencies, will be approximately proportionate to the care expended on the choice and placing of the circuit components. Stray capacities are just another pair of words for neutralizing difficulties at high frequencies, and poor dielectric materials can be directly translated into power loss and erratic behavior.

I fervently hope that you are never troubled with parasites (parasitic oscillations). They're measly little things that run around in circles heating up the plates, raising Ned with the grids, and using great numbers of valuable watts for their own fiendish purposes. They are nasty little things to be avoided at all costs. The same conditions of design which assure high-frequency operation and stable neutralization—namely, short leads and symmetry—will keep them out of most ham transmitters Failing this, the "de-lousing" must be accomplished by small u.h.f. r.f. chokes.

The layout of the last two stages of "Progressive III" is shown in figure 3. The symmetry of design, and the absence of stray unbalancing capacities is eloquently testified to by the absence of any necessity for adjustment of neutralizing capacities during band-changing.

The chassis of the two final stages as well as that of the exciter unit has been placed well up from the bottom edge of the panel to allow the installation of equipment below deck. The chassis thus serves both as a mounting for the component parts and as a shield between grid and plate tanks. With the exception of the increase in the size of the parts, necessary to handle the added power, the T-55 driver stage is identical to the 756 stage. They are brothers under the skin, electrically.

Again the stage is capacity coupled to its driver. It tunes easily, neutralizes well and delivers at all frequencies more than enough output to drive the final stage to full output.

Unquestionably, a smaller tube could have been used in this driver stage. However, with the T-55 in the moderate price range the arvantage of the reserve excitation it provided

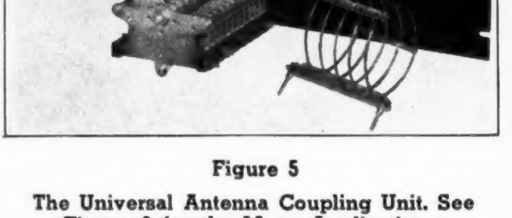
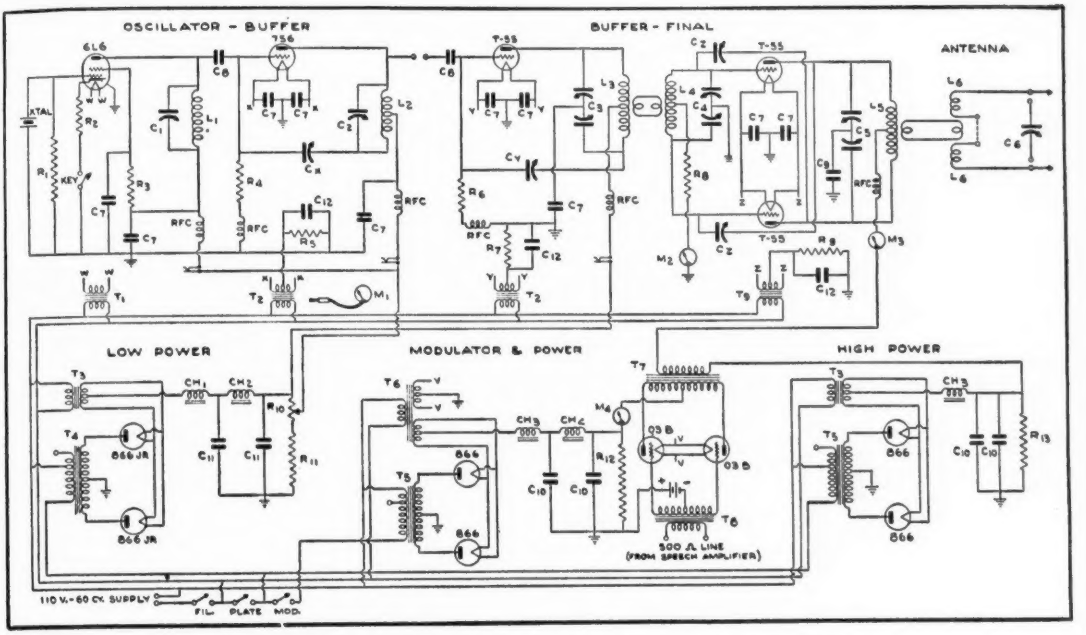


Figure 5

The Universal Antenna Coupling Unit. See Figure 6 for the Many Applications.

practically dictated its use in this position. It is nice to have a reserve of excitation when plate modulating the final stage.

Everything described thus far is powered from a single source of supply—namely, the "Lo" power unit of figure 7 using the new 866 Jr. rectifiers. It constitutes, therefore, another complete transmitter, capable of 150 watts in-



General Wiring Diagram of the Complete "Progressive" Transmitter

- C_1—150 μμfd. midget variable
- C_2—150 μμfd. midget variable
- C_3—210 μμfd. per section
- C_4—210 μμfd. per section
- C_5—240 μμfd. per section
- C_6—110 μμfd.
- C_7—.001 μfd. mica, 1000 v.
- C_8—.0001 μfd. mica, 1000 v.
- C_9—.005 μfd. mica, 2500 v.
- C_{10}—2 μfd. Oil filled, 1500 v.
- C_{11}—2 μfd. Oil filled, 1000 v.
- C_{12}—1 μfd. paper, 200 v.
- C_X—30 μμfd., neutralizer
- C_Y—5 μμfd., neutralizer
- C_Z—5 μμfd., neutralizer
- R_1—50,000 ohms, 1 watt
- R_2—400 ohms, 10 watts
- R_3—75,000 ohms, 10 watts
- R_4—15,000 ohms, 10 watts
- R_5—1,500 ohms, 30 watt variable
- R_6—4,000 ohms, 10 watts
- R_7—1,500 ohms, 55 watt variable
- R_8—3,000 ohms, 20 watts
- R_9—1,000 ohms, 100 watt variable
- R_{10}—2,500 ohms, 100 watt variable
- R_{11}—25,000 ohms, 55 watts
- R_{12}—30,000 ohms, 100 watts
- R_{13}—40,000 ohms, 100 watts
- T_1—Fil. trans., 6.3 v. at 3 amp.
- T_2—Fil. trans., 7.5 v. at 3.25 amp., c.t.
- T_3—Fil. trans., 2.5 v. at 10 amp. c.t.
- T_4—750 v. or 1000 v. each side c.t., 300 ma.
- T_5—1450 v. or 1750 v. each side c.t., 400 ma.
- T_6—Fil. trans., 2.5 v. at 10 amp., 10 v. at 6.5 amp.
- T_7—Modulation trans. p.p. 03B's to 4,000, 7,500 ohms
- T_8—Input trans. 500 ohm line to 03B grids
- T_9—Fil. trans. 7.5 v. at 6.5 amp., c.t.
- CH_1—Swinging choke, 200 ma.
- CH_2—8 henries, 200 ma.
- CH_3—Swinging choke, 400 ma.
- CH_4—8 henries, 400 ma.
- RFC—35 mh.
- M_1—0-150 ma., d.c.
- M_2—0-100 ma., d.c.
- M_3—0-500 ma., d.c.
- M_4—0-300 ma., d.c.
- SW—S.P.S.T., 10 amp.
- L_1—Receiver coil form
- L_2—Receiver coil form
- L_3—Buffer coil form
- L_4—Buffer coil form
- L_5—Type TL inductors
- L_6—Type 20A inductors

put and accomplished simply by "adding on" a tube, coil, condenser and a few miscellaneous additional parts.

The final stage with its pair of T-55's is built on the same chassis as the driver. Stray radiation from wiring is confined by the vertical shield between the grid circuits. Their respective plate circuits are further decoupled by setting the coil fields at right angles (figure 3).

Proper excitation to the final stage is of utmost importance and therefore link coupling is in order at this point. The low impedance line drops under the chassis and through the shield to the grid tank. A glance at this grid tank (figure 4) may seem to belie the conversation concerning short leads, appearing in an earlier paragraph. However, these leads were purposely lengthened to keep them out of resonance with the plate leads of the same stage, thus avoiding another pitfall leading to parasitic oscillations.

It always has seemed a good idea to have the plate tank coil and its condenser somewhere in the same general vicinity. In this layout they couldn't be much more neighborly; they are practically wedded. The standard Coto-Coil mounting was taken down and reassembled with a pair of transformer-mounting brackets, and it fits on the Cardwell plate condenser like a glove, forming a sturdy mounting with leads "shorter than possible". The neutralizing condensers have been mounted below the chassis, between the grid tank and its condenser, and ganged for convenience in manipulation—another factor made possible only by short leads and symmetry.

Metering of the complete r.f. line is accomplished by three milliammeters: a 0-500 ma. in the final plate circuit, a 0-100 ma. in the final grid, and a 0-150 ma. provided with a cord and plug, to serve the plate circuits of the oscillator and the buffers.

Antenna Coupling

Having thus acquired the means for generating a thoroughly respectable quantity of r.f. there still remained the problem of getting it from the final tank into the antenna. This is no trick in itself if you can decide on one type of antenna and, having erected it, stay with it from now on, henceforth and forever. But if you're anything like the author, the other fellow's sky wire always looks better than your own and you are always plagued with the suspicion that something else might work better, and there's no peace or contentment until you have tried it to find out. For a long time I have thought that it would be nice if someone would invent something that would permit me to indulge this mania for changing sky-wires without having to clutter up the transmitter with a scramble of wires and clips that shift with each passing truck and look like a ham version of a rat's nest. But nobody did, until we finally forced Gerry to the unpleasant job of thinking about it himself. The off-spring of his mental writhings is a gadget which, though faintly reminiscent of a Rube Goldberg drawing, will nevertheless couple the final tank to just about anything but the family automobile.

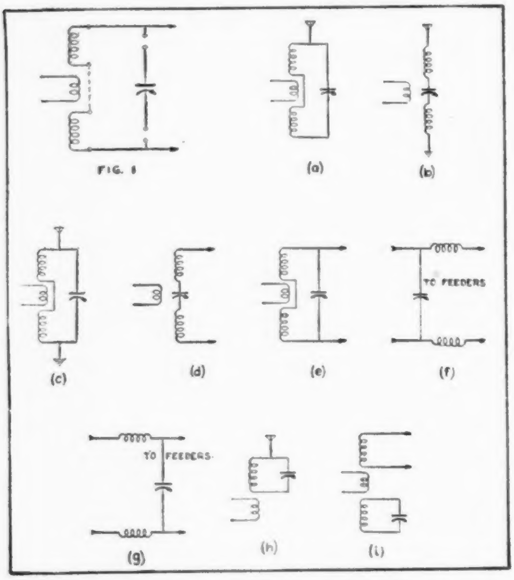


FIGURE 6: Some of the many applications of the Universal Antenna Coupling Unit.

It consists merely of a substantial condenser, six receptacle-type stand-off insulators, a pair of insulating binding-posts, and as many coils, mounted on standard, pin-type mounting strips, as are needed. Each of the stand-offs is provided with a small brass strip carrying an additional jack, and the six are mounted judiciously, as shown in figure 5.

Some of the tricks it will do are shown in figure 6, and all of them without the necessity of untwisting a connection or hanging a coil hopefully, if precariously, in space. You can take it from ye author, it is one of the handiest gadgets in the shack. Out of the very goodness of my heart I present it to you, without charge and without obligation. For them as needs series tuning of matched feeders, the jack-type stand-offs can be substituted for the binding-posts and another condenser added, and lo! the job is complete.

Power Supplies

Power for the transmitter is obtained from two separate supplies, both of which are essentially conventional in design.

The low power unit is shown in figure 7 (third unit from the bottom) and delivers plate voltage to the oscillator, doubler and driver stages, with which it forms a complete transmitter, as mentioned previously. Power for the final stage is obtained from a second, or high power stage. Both stages are controlled by a front-panel switch which is connected in series with the main filament switch to prevent accidental application of plate voltage while the filaments are off. These switches are also wired to a phenolic plug on the back of the low power chassis (rear-right corner of the chassis) providing a plug-in attachment for remote control, either by switch, or push-buttons and relay.

The modulation stage, employing a pair of Taylor 03B's in class B, occupies a space between the low and high power supplies, and is complete with its own power source. The photograph shows the class B transformer directly behind the 03B's, with the power supply, delivering 1350 volts, on the right and the 500 ohm input transformer in the extreme left foreground. The jack-type stand-offs provide input and output leads for the high voltage to the final. Plate input to the modulators is indicated by the 0-300 ma. meter on the panel. All speech equipment, with the exception of the modulator itself, has been left out of the rack,

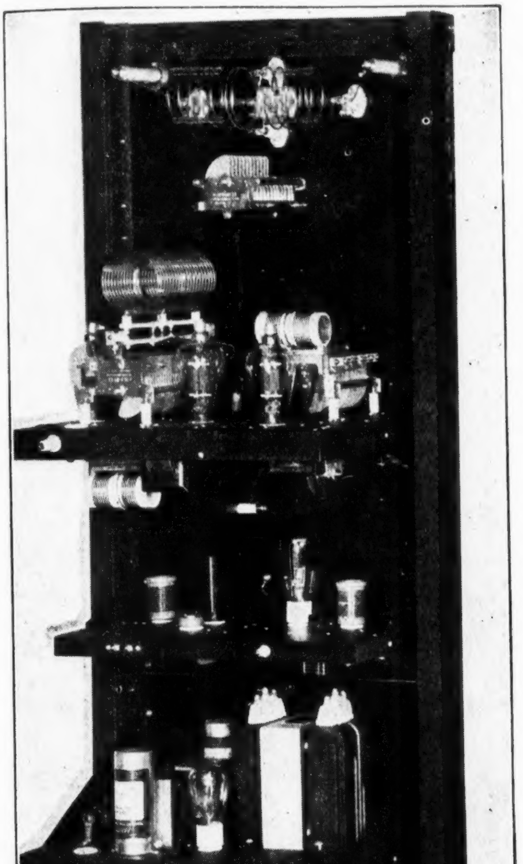


FIGURE 7: Back View of the Transmitter, Showing Relative Positions of Various Decks. Note That All Heavy Components Are Located in the Lower Decks.

on the theory that one good speech amplifier is all that most hams can afford, and that having afforded one it should be available for more than one purpose.

All inter-stage leads, with the exception of the high-voltage plate lead, are cabled and connections made to each stage through multi-prong plugs and sockets of phenolic or Isolantite materials. This permits isolation and removal of any chassis merely by pulling the plug, and believe me, that is a convenience not to be overlooked.

In operation, the "Progressive III" has fulfilled all of the requirements originally set for it, and a few more to boot. Output is adequate on all bands. The unit is designed to take a rated input of 450 watts to the final stage. It takes the full 450 watts on all bands, either cw or phone. It is not necessary to reduce the power input when operating on phone or on the higher frequencies as is so often necessary on ham rigs. Band-changing is painless and the whole outfit can be handled from one place without the operator having to look and act like an organist playing "Kitten on the Keys" on a four-manual pipe organ. Oscilloscopic modulation patterns are as close to perfect as you'll find in a Ham rig and reports have been more than gratifying, particularly on phone. For those who itch to try a similar rig, the diagrams and photos will give most of the necessary information, and the author or the designer will be glad to assist with whatever additional constructional details seem necessary.

And thus ends the story of the rig that started with a little 6L6, and grew and grew.

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Some people are just born lucky, W6ABF for instance. The first time he changed bands on his multi-stage kilowatt phone transmitter, he tuned it up very carefully all down the line a stage at a time only to notice when the procedure was completed that the dial settings on all the condensers were *exactly the same as for the other band* excepting the final plate tank condenser, which necessarily requires different settings for good "Q" on both bands. We have known amateurs to spend days trying to trim the various coils so that the condensers on the buffer stages would not require retuning.

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Did you ever think of your station as having a tune? Wave-lengths were referred to in the early days of wireless as station *tunes*. That was before they had bands, too.

QTH Contest

We have heard of stations or transmitters being located in attics, kitchens, closets, jails, mortuaries, trailers, tank houses . . . even revamped outhouses. For a good snapshot of the "shack" or transmitter in the most unusual location, RADIO will give one RK-39 tetrode (new shielded type).

All snaps become the property of RADIO; those that we consider most interesting will be run in the magazine.

Contest closes July 30th.

YL Photos Wanted

A number of readers have suggested that we run some photographs of YL's who are hams in their own right. We'll be glad to do so if the response is sufficient. Call must be given. If the photograph is sent in by someone other than the YL herself, written permission for its publication must be secured.

"General Interest" Photos

There also have been suggestions that "general interest" photographs with a radio flavor be published. We don't know just what these are, but would be glad to see your idea of one. A minimum of $1.00 will be paid for each published.

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WAZ and Moving

The question has arisen as to whether or not one should count zones for a w.a.z. score when part were worked under a different call but by the same operator. In other words, W4SLC works 27 zones, and then moves to the 5th district and under his "5" call works 6 more zones. Should he be credited with 33 zones?

It is obvious that an operator who moves from the east coast to the west coast or vice versa has a better chance of running up a lot of zones than an amateur who must work all his zones from one location. On the other hand, just because an amateur lets his call expire and gets a new one, or because an amateur moves 100 miles and lands in another call area, is no reason he should not be allowed to count all the zones worked. It is a very difficult problem, with lots of "angles". However, after due consideration, it was decided that all zones may be counted if they are worked from within the same *zone*. If you move from zone 3 to zone 4 or 5, you can only count your score as the most zones worked *from within any one zone.*

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Contest Winners

Best suggestions for renaming four of RADIO's departments were turned in by Ira F. Kuebel, ex K5AD, of the 97th Observation Squadron at Mitchell Field, N.Y., who submitted the best new title for the present "Postscripts and Announcements"; Carl J. Spehr, W9ORM, of Denton, Neb., for "Calls Heard and Dx Department"; M. V. Winston, W8QGW, of Canadaigua, N.Y., for "The Question Box", and Carson Nohrnberg, W6MKO, of Madera, Calif., for "What's New" department.

Mr. W. H. Bailey, W9FNK, was adjudged winner of the oddity contest recently conducted by this magazine, and as a prize he received two Taylor T-20's.

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F.C.C. Rules Amended

The Telegraph Division, at its meeting of April 13, 1937, amended Rules 411 and 442 to read as follows:

Rule 411. An applicant who fails examination for amateur privileges may not take another examination for such privileges within 3 months, except that this rule shall not apply to successive examinations at a point named in rule 30a.

Rule 442. An applicant who fails examination for operator license of professional class may not be reexamined within 3 months, but this does not apply to examination of radio-telephone type following one of radiotelegraph type, nor vice versa, nor one for lower class following one for higher class of the same type, nor to successive examinations at a point named in Rule 30a.

◆

Signal Squisher Notes

By arranging a horizontal Signal Squisher (May RADIO, page 16) so that it can be rotated through 360 degrees instead of a mere 180, it is possible to choose between two vertical angles of radiation by simply mounting the array at an angle.

W6FTU, who made his Squisher tiltable as well as rotatable, found that the optimum angle varied considerably with distance and time of day. Under certain conditions a very low angle of radiation was found desirable, while for short-haul work at certain times of the day a much higher angle was desirable.

To get a very low angle of maximum radi-

ation, it is necessary to tilt the array *forward* at an angle of about 15 degrees. Offhand it would look as though this would "throw the signal into the ground", but because of the fact that the presence of the ground tends to raise the angle of radiation over what it would be in free space, the resultant effect is a vertical pattern with the tip of the lobe between 5 and 10 degrees above the earth. With the array in this position, the maximum radiation in the opposite direction (off the "back") is at a relatively high angle, about 30 or 35 degrees above the earth. The *exact* vertical angle of maximum radiation in any case will depend upon the height of the array above the "effective earth", and therefore will vary slightly with different installations.

If the array is rotatable through 360 degrees, it is readily apparent that one has his choice of either high or low angle radiation in any direction. Incidentally, vertical directivity is every bit as important as horizontal directivity on the higher frequency bands, and a surprising gain can be realized by using the optimum angle of radiation for a given time and distance.

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Amateurs throughout the world will be glad to know that it looks very much as though the Italian government will soon license radio amateurs in that country.

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Philatelic Hams

Not content with hamming alone as a hobby, the following are among those who collect stamps as well as dx and radio apparatus. RADIO invites other "philatelic hams" to send in their names.

The y.l.'s include Dorothy Wilkins, W1FTJ, 71 North Adams Street, Manchester, N. H.; Alice R. Bourke, W9DXX, 2560 East 72nd Place, Chicago, Ill., and Jane Fox, HI5X, Box 127, Ciudad Trujillo, Dominican Republic.

W9DXX is a member of the American Philatelic Society and International Ham Stamp Exchange. She specializes in mint and used U.S. stamps and those of Germany, Belgium, Luxemburg and Vatican City. She is also adding to a general collection.

Canadian "ham philatelists" are W. R. Savage, VE4EO, 410 12th St., B. North, Lethbridge, Alta.; J. R. Fenwick, VE1EH, Hampton, N.B.; Charles Richards, VE5MN, Box 449, Penticton, B.C., and Dr. H. J. Hocking, VE5FG, Prince George, B.C. VE5FG specializes in British Colonial stamps.

Other foreign stamp collectors are represented by J. J. Van Ravesteyn, ZU1T, 45 Waterkant Street, Noorder Paarl, South Africa; Jack D. Parminter, ZL2OU, Wairoa, Hawkes Bay,

N.Z.; Maurice de la Brosse, F8LM, 1 rue Milton, Paris 9e, France; B. V. Helmer-Hansen, OZ8B, Soendergade 6, Nakskov, Denmark, and ZL4CU.

American duo-hobbists are:

Richard A. TenEyck, W2JJT, 9 Conger Ave., Haverstraw, N.Y.
Frank Frisch, W2JVU, 1409 Brook Ave., New York City
Daniel Farkas, W2INO, 1140 College Ave., New York City
Gerard E. Lavellee, W2JYA, 1649 Bayshore Ave., New York City.
Henry J. Geist, W3AOH, Box 12, Churchville, Pa.
Leroy G. Leighton, W4FM, 2840 Selma Street, Jacksonville, Fla.
Davis Fuller, W5EMI, 604½ Kihekah Street, Pawkuska, Okla.
E. A. Piercy, W6CID, 710 East Orange St., Santa Maria, Calif.
Henry H. Wilson, W6NCT, Box 636, Santa Barbara, Calif.
Eric T. Ledin, W6MUF, 244 Excelsior Lane, Sausalito, Calif.
Charles E. Reed, W7ANN, 303 North 13th St., Shelton, Wash.
Ernest O. Robbin, W7AIT, 124 North Fir St., Olympia, Wash.
Sidney D. Shaw, W7OAL, Route 6, Salem, Ore.
R. W. Haynes, W8FOV, 1912 Begole Street, Flint, Mich.
E. A. Reichmann, W8BNK, 409½ East First Street, Uhrichsville, Ohio.
Roy Rennacker, Jr., W9NGD, Winnetka, Ill.
Carl A. Kowalski, W9IDZ, 149 Andrew Place, W. Lafayette, Ind.

◆

Bi-Push Notes

A String Around Your Crystal

One way to remember to throw the bandswitch on your "Bi-Push" exciter when changing bands (and thus protecting the crystal) is to follow this procedure:

When changing bands, plug the crystal in *last*, and do not plug it in without first making sure the bandswitch is in the correct position. Simple . . . never plug in the crystal until everything else, including the bandswitch, has been correctly changed.

Isolantite Base 6L6's

We notice that the newer Raytheon isolantite base 6L6-G's are coming through with octal bases instead of 6-prong bases.

8 Meter Police Work

At least one police department is using a modulated Bi-Push unit for the home station in their 2-way u.h.f. system, and with very gratifying results. A "32 meter" crystal is used with the following dimension coils: Oscillator, 16 turns slightly spaced or 14 turns close wound no. 18 d.c.c. on 1½" diameter form. Doubler, regular 20 meter Bi-Push coil. Final, 3 turns no. 16 bare on isolanite form 1⅛" diameter. For coil jumper connections, refer to original Bi-Push diagram.

The unit delivers 30 watts output on frequencies between 37,000 and 38,000 kc. If

more antenna power is desired, the unit makes an excellent exciter for a high power stage.

By dispensing with the plug-in coil feature in the last stage (unnecessary for fixed-frequency work) and making connections directly to the tuning condenser and 6L6 sockets, the number of turns in the coil may be increased to 4 or 5 and an increase in 8-meter output noted (5 or 10 watts additional output). The reason for this is that at such high frequencies the coil jumpers and leads form an appreciable part of the total circuit inductance.

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U.H.F. Markers and "Beacons"

Those interested in five meter dx should know the frequencies used by several companies to broadcast television pictures and sound. If any of these stations are heard, very likely amateur contacts to the same area will be possible, if anyone there is listening. The television schedules are not available to us at this moment, so we cannot say just how much of the time these transmitters are in operation. Here they are:

Service	*Location*	*Visual*	*Sound*
Farnsworth	Philadelphia	62.75 Mc.	66 Mc.
Philco	Philadelphia	51 Mc.	54.25 Mc.
RCA	New York City	49.75 Mc.	52 Mc.
BBC	London	45 Mc.	41.5 Mc.
Post Office	Berlin	"7 Meters"	
State B. S.	Paris	"7 Meters"	
Philips	Netherlands	41.2 Mc.	42.5 Mc.

◆

I.R.E. CONVENTION NOTES

There have been a great number of papers presented at the IRE convention at New York City that are of interest to the amateur fraternity. On the second day was given a particularly useful one to those interested in high power ultra-high frequency transmission. It is entitled "The Development Problems and Operating Characteristics of a New Ultra-High-Frequency Triode" and was given by Mr. W. G. Wagener of the RCA Manufacturing Company.

The tube is a miniature water cooled, and is capable of 700 watts output on 100 Mc. and 500 watts on 200 Mc. or $1\frac{1}{2}$ meters. The most important contributing feature to the unusually large ultra-high frequency output of this tube is extremely small size of the elements. Since the transit time for electrons to travel from cathode to plate may be as short as one five hundred millionth of a second for 100 Mc. operation, it can be seen that close spacing of the elements is imperative. In this tube the actual spacing between cathode and grid is only .06 inches. Thus, due to the proportionately small size of the plate, water cooling is required to carry away the heat dissipated by the elements.

In another interesting paper "Effects of Space Charge in the Grid-Anode Region of Vacuum Tubes", B. Salzberg and A. V. Haeff disclosed the fact that under certain conditions a vacuum tube will show characteristics that are the reverse of its normal operation. They also reveal another very surprising fact that when the operation of a tube is measured with a series of increasing potentials, the tube will show one set of characteristics, but when the measurements are made with a succession of decreasing potentials the behavior may be quite different. These results were first arrived at by means of mathematics and later proved by means of an especially constructed tube.

Still another paper, "Study in Changes in Contact Potential" by E. A. Lederer, D. H. Walmsley, and E. G. Widell, may be of especial interest to vacuum tube manufacturers. It was discovered that a sub-microscopic layer of oxide on the surface of an electrode may seriously alter the characteristics of a vacuum tube. This disclosure, supported by laboratory tests, indicated the desirability of using metallic parts, of extreme cleanliness, in tube production. Electron bombardment of this molecular layer of oxide may give rise to gas liberation which will disturb the extremely high vacuum, about one ten-billionth atmosphere, required by modern high-emission high-voltage tubes. It was further stated that cleanliness of this order requires the use of chemical action after the tube has been exhausted and sealed.

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A New "Ten" Meter Band?

Bill Conklin, W9FM, received the following in his "ten meter" mail. The writer is definitely a phone man, but not adverse to using the key once in a while.

* * *

"Bill, I got me one big gripe and just won't rest until something is done one way or the other about it. It's this 20 to 30 Mc. situation. It gives me a big laugh to hear some fone bird with a kilowatt input on 28 Mc. ready to chew the ears of any and sundry c.w. guy who has the audacity to interfere with this bird's blah-blah. For the past few weeks, especially on Sundays, my transmitter has been parked beyond 29,000 kc. and I call many wistful CQ's and listen to them come out of the loudspeaker, all day long. After a nice long drawn out CQ I quickly switch on the receiver and slowly, oh so slowly, comb the section of my receiver which is labeled "29 to 30 Mc." and what do I hear? Just great big gobs of nothing!

"Then with anguish and disgust I sneak up to 28 Mc. (oh yes, right up to 28 Mc.) and hear three half-kilowatt phones and four

c.w. stations *trying* to communicate on exactly one channel, and the net result is one nice cat and dog fight. After a few minutes of that I go down below 29 Mc., light my pipe, and listen to a real band.

"For the last few Sundays I have managed to get one contact a day in with a station on 29.5 Mc. That one lone contact usually repays me, as it is always QRM-free and lasts until we are all talked out.

"You hear these sea-going lawyers on ten meter phone, rattling their brains and making up schemes as to how to clean up the band for fone. If they are so doggone civic-minded, why don't a few of them grind a crystal down to 29 Mc. and beyond, and put a signal there on code? Show these "uneducated" c.w. operators that a signal can be heard down there, and set an example. Then when the c.w. boys are shown, these Gospel Singers can go back to their "deserted" 28 to 29 Mc. and again peacefully make a lot of noise among themselves on phone. Maybe these particular sea-lawyer ten meter phone men cannot copy code.

"But no, instead of doing something constructive like the above, they hatch up selfish schemes like, among a few, to assign (mind you, *assign*) a portion of the band, namely 28.0 to 28.1 Mc., for dx only, spreading the word far and wide to boycott any American station working in that portion, and leave that for dx like K6MVV. Since when is Hawaii dx on ten meters, or any band for that matter?

"Well, I operate phone now and then on 28,060 kc. and many a day last summer I called CQ and heard nothing for weeks. I can still do that above 29 Mc. and enjoy myself plenty. I suggest that you publish a Calls Heard list, covering 29 to 30 Mc. c.w., each month. If you could only coerce a few Europeans and VK stations down there, the deed will be done. I want to be the first station to make a W.A.C. on *ten meters,* which is 30,000 kc. It has only been done as far as 28,000 kc. or so. I have a good start now, having already worked a couple of W stations; it's in the bag!"

◆

OPEN FORUM

[*Continued from Page 9*]

sistently refused to operate here, why shouldn't this band be used to relieve the terrible congestion on the 160 and 75 meter phone bands? Will *you* please ask Mr. Warner for us just why he had this band restricted to c.w.; he won't answer *us*.

Now that nearly all armory stations have their own calls and frequencies, the argument of keeping a part of 160 for military stations doesn't hold water. The ones that use the ham bands mostly use 80 anyway. So why shouldn't the entire 160 meter band be returned to the phones?

R. B. JEFFREY, W9ZDH.
Minneapolis, Minn.

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HAW!

Medford, Ore.

Sirs:

I have just finished reading for the 'steenth time W6KMQ's letter in the May Open Forum. If there was ever an article that contained more real honest-to-gosh common sense, I'd sure like to know where and when! I hereby respectfully remove my hat in his honor. And, when *I* take off *my* hat to a W6, it really means sumpin'! Mebby I'm so enthusiastic because he expresses my own ideas. Boy, I would sure hate to be taken apart so thoroughly as some of the crabbers he poured it on!! Looks like they kinda led with their chins.

In one point only do I disagree with "Doc" and that is that what to do when ham radio ceases to afford a diversion and when I give it up, I will take up sheep-herding, not golf or pinochle. Hi!

I got several belly-laffs when read'ng the list of boys whose dx logs were considered ineligible because of out-of-band operation *and* lousy notes, haw! Some of 'em surely had it coming.

G. S. "Shovel Ears" Turner, W7CIK.

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W.A.C.A.?

Sirs:

Making w.a.c. in record time undoubtedly packs a wallop for the one fortunate enough to do it. Most of us, however, and especially those of us using low power transmitters, are not able to accomplish much along the line of setting a record for w.a.c. in our own Call Area.

There is one thing we can try, though, and that is to see in how short a time we can work all Call Areas. At first thought this sounds too easy, but it is not quite so simple as it seems. The nine contacts should be made without any pre-arranged schedules; a QSO must consist of an exchange and acknowledgment of signal

reports at least; and a local QSO will not count for a contact; these would be my suggestions for rules.

If you think this a good idea, you might publish this letter, and the fellows would write to you telling of their records. You might publish the best time made in each Call Area for a while, at least until the novelty wears off.

What do you think of the suggestion?

L. A. Morrow, W9VKF.

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ANY SUGGESTIONS?

Albany, N. Y.

Sirs:

I am writing to you in request for information to help revive our radio club.

We have many advantages such as a transmitter, a communications receiver, club rooms in a convenient location, free publicity in a local newspaper, free printing of stationery and posters, money in the treasury, and a small membership.

Our group was organized about three years ago. Since then we have had several open house parties and membership drives with good results. Our only trouble is in keeping members interested.

Lessons in radio theory and code practice helped us to keep members active. These lessons were not continued very long as no outline was prepared for them and the instructor taught whatever he pleased. These lectures were usually too far advanced.

Most of our members are beginners and a complete course in radio theory would certainly be helpful. Can you tell us where we can get such a course without great expense? Have you any suggestions for keeping our club alive?

Any assistance will be greatly appreciated.

Manson McNamara
435 Clinton Ave.

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S.W.L. COMMENTS

Brooklyn, New York.

Sirs:

The next time you find an s.w.l. card in your mail from a chap across the town, pay him a visit. Such a kindness will not only flatter the s.w.l. but also prove a valuable opportunity whereby the ham can with a glance or two determine the extent of the activities at that QRA. The least bit of xmitting apparatus will stand out like a sore thumb and if such equipment is noticed, valuable advice can be administered then and there. That particular QRA will bear watching in the future.

Should everything appear bonafide and the s.w.l. appear to possess the qualities necessary for a valued addition to the ham fraternity, by all means encourage him to study for a license. With all the talk of further restrictions on newcomers to ham radio it is sensible now to realize that the amateur will always be a minority. Suppose a wholesale recruiting of new hams will saturate the ham bands to a new breaking point; it will be regretable in a minor manner but to a greater purpose it will make the amateur an exceedingly more powerful minority and the powers that be will be forced to take more notice of the amateur.

How many hams take the trouble to check their logs with reports sent to them by the s.w.l.? Do they realize that the s.w.l. report is the finest means of determining whether or not their call is being pirated? Keep an extremely accurate log at all times and check the s.w.l. reports with it. A general return to the old custom of 100% QSL will also check on the activities of pirates. What can be more convincing than a QSL from a brother ham telling another ham that he enjoyed the QSO of such and such a date? Really, it is

because the ham has fallen into evil ways that the bootleg situation has become critical. He is himself to blame for the condition.

In crowded metropolitan areas the situation must be met in quite another manner. It is important that club committees be formed with the express purpose of discovering the bootleggers. It is my opinion that only a few of the culprits will have to be smoked out by the use of portable-mobile rigs. I invite the wrath of other readers of the Open Forum by emphatically stating that in the majority of cases some ham has knowledge of the activities of a pirate and in some isolated cases has been instrumental in helping the illegal operator to get on the air. I personally know of several instances of that nature. It is downright disgusting and the real culprit in such cases is the ham himself. It is just as possible that those particular hams were bootleggers themselves at one time. The whole situation calls for a weeding out process and if the weeding out is thoroughly accomplished there will be plenty of room in all bands for the newcomer. I would say that it is time the ham ceased his belly-aching on the pirate situation and commenced to look about him for the real laxities on his part that have permitted the condition to reach such an alarming point.

Some fellows would have you believe the s.w.l. a pest. I admit that the high powered boys must receive an enormous number of s.w.l. reports, and mainly through the very force of their numbers these reports lose their value. The writer, however, has letters from hams in answer to s.w.l. reports that are so gratifying and appreciative that he shall continue sending out his reports until his expected license arrives. With what pleasure is the s.w.l. report received by the ham who has never had an out-of-town QSO because his rig was not functioning properly? I have been party to such an instance and the encouragement received from that ham's joy prompts the statement that the real s.w.l. will keep sending his reports no matter how poor the response, in the hope of bringing some joy and valued information to the chap that is experiencing trouble in getting out. What has this last paragraph got to do with eliminating bootleggers? It is written to bring about a keener appreciation by the ham for the s.w.l. who someday will either become a ham with the encouragement of those already blessed with a ticket or a bootlegger damned into such an illegal position by the callousness of some ham.

"EGYPT" SMITH, S.W.L.

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YOUNGSTERS OF ALL AGES

Wilmington, Dela.

Sirs:

Why are the young fellows continually picked on and criticized just because it is assumed that those under 18 years of age lack sufficient knowledge to cope with this hobby? There are a goodly number of excellent operators not yet 18 years old who deserve their few cycles on the dials more than do some of the older lads with

their half kw., commercially-built transmitters, sniggle-sniggle receivers of well-known brands, and constant griping about conditions. In fact, I'd rather see these youngsters cast ballots at elections than some who have gained the privilege because they were born a little sooner.

Nope, I'm not one of these under-18-years-of-age squirts. And I'm not a newcomer. My pedigree, as far as hamming is concerned, includes working more than 100 different stations on 56 Mc., possessing a Class A license, working more than 50 different countries, working dx on 80, 40, 20, 10, and 5 meters, and having a station that's right on a public highway where the car noise is plenty bad. I've never had more than 100 watts input either.

But to proceed: It certainly looks nowadays as if a person must possess the abilities of a commercial operator to be entitled to his ham ticket. Yep, it seems as if the major difference between a commercial and an amateur is that one gets paid and the other pays.

You bet we could use more kilocycles. It would be great. On the other hand, it really isn't so bad now. If you can't get out on 20, try 80. The boys will be glad to hear you and you can help fill up some of those big gaps between stations which are so prevalent in the daytime now.

If you work dx all of the time, take a rest and work a few of the W's. They are great fellows and it is sort of nice to see how the other half lives.

Then, when you hear the newcomer on the air and things don't sound up to snuff, don't write to a magazine about it—invite him over, show him how nice crystal control is, and so forth. He will be glad to see and learn, and he will probably like you a lot more.

Don't complain about the bootleggers on five meters unless they are bothering you. If you seriously consider it, just exactly why should a person be able to receive $13\frac{1}{2}$ w.p.m. to work 56 Mc. phone? How many SOS's do you hear on five meters? And, honestly, fellows, you know darned well that if a chap finally does learn the code to the extent of procuring a license, before long he will be on the lower frequencies to add to the QRM so often complained about. Don't help them; it's too risky. They will be up on 40 c.w. QRM-ing you soon enough, anyhow.

Finally, don't keep harping on restrictions for anyone or anything. We will get them soon enough without asking for them. If you think that things are too tough for you in this game of ham radio, try astronomy . . . you can all look at once without bothering each other!

LENNIE YERGER, W3BTQ.

HOGS VS. LIDS

West Lafayette, Indiana.

Sirs:

I haven't read Mr. Pyle's article referred to in 9UBB's contribution to the April "Open Forum." But, I find a few objections to Mr. Holmberg's views.

Not more than 20 per cent of the hams I have met during my five years in the game have been dx hogs. And, I resent his calling the other 80 per cent "lids." That is a nasty term. I might point to the malpractice of

long "cq dx's" which are so frequently heard from those who want to have a "decent QSO with our foreign friends." Incidentally, what is the correct definition of "decent"?

My first transmitter was of necessity built for $1.14. It worked well and caused no undue interference or key clicks. The same thing can and is being done today. Further, if 9UBB believes the ham bands are terrible now, as he appears to think, what would he have thought of them five or ten years ago? With former conditions in mind, I think that the bands of today are f.b. They aren't half as bad as our newly-hatched hams, who have never really had tough QRM or QRN conditions, seem to think they are.

I balk at the 18-year age limit. Is a man with 15 years of business experience more capable of operating a transmitter than a kid with three years of mathematics, a year of general science, a year of physics, and possibly a year of electrical shop practice? And, even if the man did have physics in high school or college, it was of a type (static electricity, permanent magnets, and discharges in Crooke's tubes) which is of little use in modern ham radio.

As concerns more government supervision, let us glance at an airway's radio station. Every 30 days or so, an inspector looks it over. All of the operators have served the equivalent to 9UBB's probation period and, of course, have commercial tickets. The receiving relay rack contains nearly a thousand dollars' worth of equipment. In short, it is well-supervised and carefully inspected, and has equipment far superior to that used by most hams. But, when it comes to communication, I would rather try wig-wag with a blind American Morse operator than I would try to understand the particular variety of hash which comes out of the antenna and speakers. Further, when the beacon is operating, every frequency from 200 to 400 kilocycles is blanked out by key clicks.

One can't tear down a current practice successfully without offering something to replace it. Here it is: Why not end QRM and poor procedure and rotten signals by the force of

public opinion, the only law which is universally enforceable? Instead of soft-soaping the offenders into a QSL card (and then telling the man across the street what a rotten operator 9— is), why not tell him to his face how badly he smells and refuse to QSO him? Not many hams would maintain sloppy sigs if they could never get anyone to talk to them.

C. B. STAFFORD, W9KWP.

"APPROVALS"

Sausalito, Calif.

Sirs:

Your offer to print calls of stamp-collecting hams is a real break. I've long looked for such a means of contacting fellow hams reckless enough to ride more than one hobby.

No doubt by advertising our weakness we will be flooded with "approvals", but I hope to come up with a handful of new friends.

ERIC T. LEDIN, W6MUF.

A NEW QSL PROBLEM

Joliet, Ill.

Sirs:

Could someone in your organization give me some official information on SWL cards? By this I mean, what really is considered good practice for a short wave listener to have on his card in regards to "call letters"?

A local ham tells me that if the ham calls are past the "S's" in that district, a short wave listener can't put on his card "W9-SWL" for instance. Is this correct? I was under the impression that the dash between the 9 and S (9-S) set it aside from an amateur's QSL card. I suppose that "SWL-W9" would be preferable, but the SWL's seem to prefer the former, and order cards with that arrangement specified.

I surely would appreciate any information on this point.*

C. FRITZ

TWO CENTS WORTH

Grosse Pointe, Mich.

Sirs:

I know you are all waiting with tongues hanging out and ears stretching a couple of feet to hear the *real* solution to the QRM problem, insofar as the "experts" are concerned! So, to relieve you, here is W8QBW's two cents' worth, which should make your troubles a thing of the past.

To begin with, let's get a true picture of ham radio—what is it, anyway? Is it important? The answer to this is *"no."* The exception, and admittedly an important one, is that it provides Uncle Sam with a supply of operators when, as and if war eventuates.

Is there such a thing as an important or "worthwhile" ham message? Again, "no"—at least, I never heard of one, with the exception, perhaps, of "Police boat rush a case of beer to 23 Knee Deep Street. Occupants parched."

Has the old-timer any real reason for consideration over a lid? Once more, "no." The description of a rig, wx conditions, a list of dx, or a tale of flashover-grief are no more important or interesting at 30 years than at 13.

Anyhow, this is a democracy (so far) and men are counted, not weighed, as the fellow said. Hence, the great majority of hams who

*Not as "official information" but as a mere suggestion we offer the following:

It would be very nice indeed if the FCC would withhold the "SWL" call in each district, and allow the SWL's to use "W9-SWL", with a dash or some method of identification to show the call is not a licensed call. The trouble is now that the "SWL" calls will probably be issued the same way as any other call—in fact "W9SWL" has already been issued. Also, due to the fact that many *amateurs* put a break, dash, or other division between the numeral and first letter of their call (don't ask us why), the use of "W9 (dash) SWL" is certainly to be discouraged among the SWL's.

"SWL-W9", "SWL-K6", "SWL-G2", etc. seems to be the answer.—EDITOR.

don't regard their hobby as the Alpha and Omaha of existence are a lot more numerous than the few "experts" who don't realize that it is, after all, an escape mechanism—as the psychologists declare. (Not a bad line, that!)

The solution? Oh yes, here it is: Forget about confining the thousands of contented hams to one or two lousy bands. Let 'em use them all, same as now, with the exception that each band would have a small segment open only to experts who have proven their proficiency. There are not so many of them and a small bit of each band would be sufficient. Then, they could scrap amongst themselves over their own QRM. The "rest of us" would worry along as before.

Take, for example, the 40-meter band, 7300 to 7000 kc. Let the experts be confined to, say, 7300 to 7250 and the other hams to 7250-7000 kc. Anyway, you know, in a zoo, they cage the lions and the monkeys . . . . the public is not confined! Most hams work only around their own crystal frequencies; who ever called a CQ on 7050 and was answered by 7250? Nobody.

Now, instead of making the lid (like me) qualify for something after he has already qualified under the F.C.C. rules, make the expert qualify for the right to use that 7300-7250 bit. The expert could roam the bands at will, but he could also have a small portion for his own exclusive use.

I will bet that there won't be many who will qualify. And then, too, the rest of us will know just where to listen in to get posted on this "important" stuff.

So, you have ol' Doc 8QBW's prescription: letting the experts qualify for their own section of each band. Simple, isn't it? Well, all great things are simple. (Ahem.)

FRED SUTTER, W8QBW-W8QDK.

•

HOBBY OR JUST HARD WORK?

Chicago, Illinois.

Sirs:

I wonder if many of the correspondents to the Open Forum aren't considering the matter of amateur radio from a selfish and deterrent viewpoint? Nearly all of them forget that after all, amateur radio is above all other things, a *hobby!*

The same group, it seems, who were so violent and vociferous as regards the matter of traffic handling, when they felt that their *business* was being encroached upon, have evidently become strengthened by added numbers of individuals who are greatly perturbed because there is so much QRM; they are unable to work as they please, at their own pleasure, and devil take the hindmost, and the rest of the amateur citizens!

Understand me! I am not opposed to traffic handling, dx rag-chewing, or any other phase of amateur radio, as a part of the game, but to place any one particular thing to such an important position in your own estimation and then to object because some other fellow does not view it in the same light, is neither sensible nor sportsmanlike.

Amateur radio is not a playground for the wealthy nor yet a proving ground for radio engineers. The lowly person with his two-tuber and 210 is entitled to as much consideration and courtesy as any of his more fortunate brethren with his umpteen tubes, crystal filters, KW class B modulators, and what not. The so-called "big shot" who so bitterly complains because some local is covering up that dx station he was working should also remember that perhaps he is blocking out half of the band upon that same local's two-tuber! Instead of becoming incensed at this condition he should become philosophic. After all, he *is* getting

the better in the exchange of QRM!

But I hesitate to shudder when they start yelling how bad the QRM is. It is bad at times, but never *too* bad! In the dx contest just concluded for instance, using a simple three tube receiver, I heard and copied some very nice R6 to 7 signals on the forty meter band, when conditions were at their worst. Quite a few of these signals were in here for two and three hours at a time, and were perfectly readable most of the time through the W QRM. I believe that this matter of hearing and working dx is more a matter of judgment and consideration than brute force and subjugation of the other local stations.

So my opinion on this matter of amateur radio is this: each amateur to his own particular sphere. To the dx'ers more dx, to the traffic handler, more traffic, and to the local rag-chewers, more rag chews. If we do not secure any of these one hundred per cent all the time, put it down as part of the game, not a black mark against your fellow amateur! Amateur radio should be a medium to produce the greatest amount of happiness for the greatest number of hams, and it is only through consideration, sportsmanship, and courtesy that this is possible. Forget all your restrictions and inhibitions and consider the other fellows for a change!

GEORGE W. CHINN, W9EUZ.

◆

Broadcast Tax Proposed

Commissioner George Henry Payne of the F.C.C. has proposed a bill to tax broadcast stations on a basis of operating power. Stations using up to 1 kw. would pay one dollar for each watt annually; those authorized to use between 1 and 10 kw., two dollars a watt; and in excess of 10 kw., three dollars a watt. It is estimated that the total revenue yielded annually by this special tax would reach $6,946,395 with the present station set-up.

Commissioner Payne says, "At best it is but a small return for the great privilege the industry enjoys in using the people's airwaves." It was mentioned to Congressman Boylan of New York that with a 40 million dollar investment, the broadcast business realized a gross revenue in excess of 107 million dollars last year and will possibly see a 130 million peak during the current year. Individual profits in the sale of broadcast stations have been as much as seven times the cost of the station, yielding in one case one and a quarter million dollars.

Should future tax legislation hit amateur radio (and it ultimately will), it is to be hoped that the rate will be based on an inverse relation. Let the low-powered boys, who spend the least to stay on the air, pay the top tax per watt. After all, 100 watts isn't 10 times as loud as 10 watts.

R.P.T.

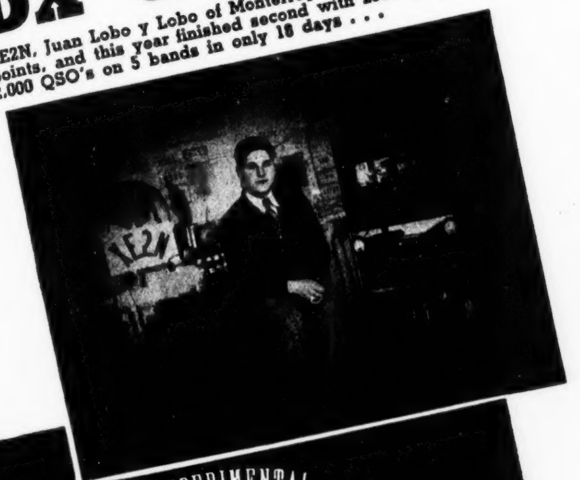
◆

In Cincinnati, a paper on "Photo-Radio Analogs" was presented, giving a number of analogies between radio and photography. One was the similarity between the emulsion exposure curve of a film and the plate-current—grid-voltage curve of a vacuum tube. Both exhibit cutoff and saturation regions.

Does this explain why so many hams are also photography bugs?

International DX CHAMPION

XE2N, Juan Lobo y Lobo of Monterrey, N. L., Mexico, who won the 1936 contest with 189,081 points, and this year finished second with 201,520 points, using only 150 watts input. Nearly 2,000 QSO's on 5 bands in only 18 days . . .



RADIO-EXPERIMENTAL

XE2N

APARTADO 710

OCAMPO 925

JUAN LOBO Y LOBO

MONTERREY, N. L., MEXICO

Amperex Electronic Products Inc.
79 Washington Street
Brooklyn, New York

Gentlemen:

It took me only two hours to build up on a bread-board a final with the HF-100 and a few minutes later, I was ready to use it from 10 to 160 meters with the same power supply used for my old 210's (1,000 volts). Even capacitative coupling was tried for more simplicity, neutralizing was so easy on all bands and Oh Boy!!! What an out-put from only 150 watts input that was all I could get from my power supply!!!

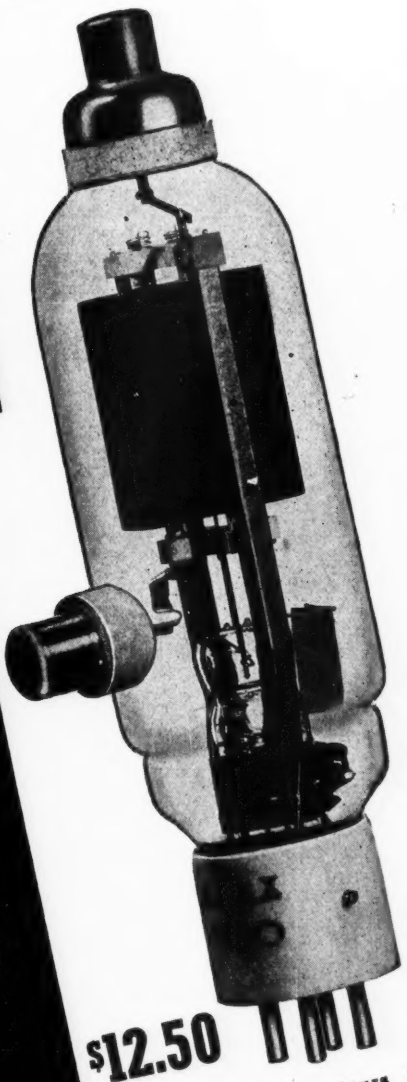
Next day the "CW" International DX Contest started and I don't need to say any thing of my signal as there are many thousands of stations all around the world that heard me during those days.

Five bands were used: 10-20-40-80 and 160 meters and near 2,000 QSO's were made during the eighteen days of the Contests. Several WAC's both on "PHONE" and "CW" were also made even it was supposed that I must work W & VE's only.

To close this letter, permit me to congratulate you for the excellent performances of the HF-100 and at the same time, recommend it to all those amateurs interested on "REAL DX."

Yours very truly,

Juan Lobo y Lobo
"xe2n"



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Thank you, XE2N, amateurs everywhere agree with you that the AMPEREX HF100 is the easiest tube to drive.

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Dx Department

[*Continued from Page 33*]

that back in 1931. Well, then to polish off the evening he hooked VE5OA at Fort Norman, N. W. T., on the Mackenzie River.

W8LZK landed YR5AA, SU1SG, FB8AB and LU8EN to make him 28 zones. Rig is p.p. T-20's with 200 watts input. Other dx includes OZ2B, OZ7CC, LA4K, U1AD, ZU1V, ZSIAL, HA8D, SM6YG and several other nice ones. Also says that EI3J has a rhombic directed on New York on about 14,070 kc. and wants W QSO's on fone. This from W6GNZ. Says that VS4CS is on fone on 14,260 kc. and that the station signing his call on 7 Mc. is a phony, as he himself has not been on 40 for a long time and intends to stay on 20 meter fone. The only other VS4 is VS4JS and he is not active on 7 Mc. VS4CS has yet to work a W on fone, and hasn't even heard one for four months. Now, my fine friends, did you know that CXIBG *does* QSL? W6GNZ says so.

W8HYC has been going after them on 10 and 20. Some of the latest are LZ2BK, YT7MT, YU7DX, FY8A, FY8C, PZ1AL, PZ1PA, CN8RU, ES5C, YL2BB, YL2BC, YL2CD, YR5AA, YR5AR, YR5VC, YR5XJ, U9MI, U9MF, ZD7Z, VU2DA. HYC says that OE3AH is the Archduke of Austria. W9NTW in Grundy Center, Iowa (wherever that is) worked VP1WB, who claims that he is getting tired of his 41's with 220 d.c. on them. Just not enough oats I guess. W9SCW has put in a pair of T-20's.

W6OEH uses a single 210 kicked by a 6L6G osc. and has worked 18 European countries. He uses three different antennas which he moves from one neighbor's roof to another . . . . depending upon what direction he wants to get into. Bet they like that! And now here are a few stations he has hooked: YR5AR, HB9J, PA0UV, OK2LO, OK1ZB, OE3ER, OE3WB, ES5D, PA0ON, PA0QZ, ZS5U, VQ8AF, OZ3J, OZ7CC, OZ7SS, GM6XI, YV5AO, YL2CD, U2NE, U5AE, OH3NP, HA8C and the usual amount of Gs, SMs, Ds, Fs, etc., W6OEH says that YV5AO is on 7,150 kc. nearly every morning around 2 or 3 . . . . p.s.t. of course. The receiver OEH uses is the one described by Dave Evans, W4DHZ, in RADIO for last June.

Up at the University of Washington there is a different kind of a radio club. It is called the Rho Epsilon Fraternity and the purpose is to have chapters in various universities throughout the country exchange college news in general and have better association over the air. At the present time there is the U of W, Washington State College, U of Idaho, U of Montana, and U of Virginia. Some of the boys in this club at U of W are W7ETN, W7ENW and W7AYO. W7ETN uses an HF-100 in his final and had his rig on the campus during

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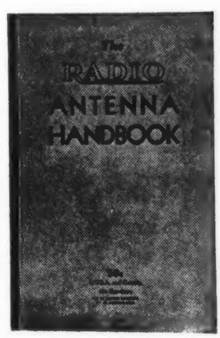

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the recent dx contest. They have worked some pretty good dx . . . . HK5JD on 7 Mc., J8CB, and some Africans, enough to make a WAC for W7ETN. W7ENW has to his credit VE1JZ, LU8EN, HAF4H, ZT5V, J6DK, ZL3GU. Those also made a WAC for him. This was done during his vacation at home, and his little rig winds up with a pair of 46's in the final.

If Stanford University had a dx club I suppose they would have a take-off of their famous football "Axe" yell, something like this:

Give 'em dx, dx, dx,
Give 'em dx, dx, dx,
Give 'em dx, Give 'em dx,
Give 'em dx, where . . .
You finish it; I give up.

W8MAH gives a few stations and their frequencies: U9MI, U9ML, U9AV, U9MF, U9AW all between 14400 and 14460 kc. U1AP, U1AD, U3QE and U2NE are also outside of the band and come in about the time the U9's are fading out. U3QT is about 14,090 and UK3AA is around 14,040; KA1US 14,300; J2LU 14,265; J2MH 14,310; J2JJ 14,270; FT4AB 14,000 and 14,050; FA8DA 14,375 to 14,420; OX3M 13,990 and a beam for USA; SV1KE 14,270; SU1CM 14,270; ZB1E the same; SU2TW 14,410. Some stations and frequencies on 7 Mc.: YR5AA 6960; YM4AA 6970; ZS2A 6980; EI4J 7080; HA8C 7070; YU7DX 6970; K7PQ 7050; VO1W 7040; LY1J 6970; HA8D 7030. Now for 28 Mc.: HA8D 28,060; YR5AA 27,900; YR5CF 28,000; YM4AA 28,000; HA8C 28,060; YU7DX 28,200; I1IT 28,200; OE1ER 28,080; OE3AH 28,100; OE7EJ 28,350; SP1LM 28,050; HB9BY 28,040; SM7UC 28,500; YL2CG 28,000. Well, fellows, there is a pile of stations which may be a help in spotting some of them in a pinch.

W6OCH has worked 24 zones on 20 meter fone and gives a couple for the boys to look for . . . . . VS4CS 14,260, and HB9AB 14120. W3TR adds a zone in hooking up with VK6YZ, making him 29. W6LCA snags FY8A for his 28th zone. Craig hasn't been on the air long but his 100TH seems to be doing its stuff.

W3UVA sent in a list of frequencies which may come in handy, and while I think of it, when you get through reading all these stations and frequencies in this issue you'll be dizzy. Anyway, you might refer to 'em for a double check on some guy you think you're working. Here is Charlie's list:

* * *

FA8CR	14,060 kc.	K7EVM	14,370 kc.
HK5OBS	13,980	YL2BB	14,400
LX1AD	14,110	UDAV	14,415
ZS1AL	14,110	U9MI	14,405
YR5AA	13,985	U9ML	14,415
ZS1AN	13,970	CP3ANE	14,415
SP1ER	13,990	ZT5Z	14,390
HA8C	14,050	ZU2B	13,980
FA8IH	14,000	ZU4M	14,390
ZS1B	14,115	CN8M1	14,310
ZS2A	13,970	PZ1PA	14,400
ZU6P	14,100	VU7FY	14,380
LY1AF	14,100	YS1FM	7,160
LY1AF	14,095	U9AW	14,420
ZE1JR	14,055	U9MJ	14,410
ET8FA	7,025	U2AE	14,360
ZD2A	7,075	I1IR	14,420
CR6AB	14,050	FT4AE	14,300
I1RRA	14,380	YL2CG	14,400
U9AW	14,415	J3FK	14,335
K4DRN (Virgin Is.)	14,400	U4AG	14,450
		YR5AR	14,415
HX1AA	7,260	K60JG (Guam)	14,300
K7PQ	7,290		
XU8JR	14,160	ZE1JN	14,370
J3FZ	14,275	J8CF	14,300
VP6MR	14,300	PK1VH	14,345
U1BL	14,400	U9AF	14,400
I1TKM	14,380	U9MF	14,420
EL2M	14,150	YVAN	14,135
U1AP	14,152	W6QD	14,400 (HI)

I used to think I knew By Goodman pretty well, but now I don't know what to think. You see By formerly was W6CAL from San Francisco and a heart breaker super plus. Now, as perhaps most of you know, he is back in West Hartford with the call W1JPE. We were thinking that inasmuch as he had such a swell call when he was in California that he would probably get something like W1CONN when he went back there. Anyway, By is on the staff of Quist, and among other duties takes care of the dx notes. In case any of you skipped over the opening paragraph of his stuff in the April issue, better get it and give it the once over. Briefly, he suggested that all those interested in working some of these countries which never seem to be on the air chip in a dollar toward a fund to be used to provide some vagabond with a kw. outfit to haul around to these various "never-heard-from" spots. For example, if you want to work three very elusive countries you pay three bucks, and when this station gets set up in those countries, he'll work you. Now, to get back to the point . . . I thought I knew By pretty well but after a brainstorm like that I'm sure the yl's have got him for sure.

The other night I went into a trance and figured out a good one but think I'll save it until that one dies down. Anyway, if the expedition gets together I've a few bucks I'd like to toss in.

•

Since the contest, to my way of thinking conditions have been terrible. Ol' Sol is probably having so many sun spots . . . . and so large . . . . that maybe we are in for a lousy season after all. It doesn't seem in the cards, but who are we to argue with Sol. However, here at the beach he hasn't deserted us . . . . no sir, why, last Sunday the x.y.l. and myself went down on the beach with Mr. and

Mrs. CUH . . . . . and all of us picked up a nice coat of sun-spots . . . . I mean sunburn.

Oh yes, there is just one more thing which I forgot to mention a while ago . . . . . and that is, I just received one of the new Coronation QSL cards from G2ZQ. It is an extra pretty card printed in red, blue and gold to be used during the Coronation year 1937. He will send one to any *real dx* station who takes the trouble to QSL.

◆

New Literature and Catalogs

Although it has but six pages, the new broadside describing Hammarlund's latest "Super-Pro" is quite complete and provides popular technical and price information, as well as curves and illustrations. The 10-meter model listed in the broadside is a new addition to the "Super-Pro" series. Amateurs may secure copies of the folder, gratis, by writing to Hammarlund Mfg. Co., Inc., 424-438 West 33rd Street, New York City.

"Instrument Topics" is the name of Clough-Brengle's new house organ just off the press and full of technical information for the users of electronic instruments. Purpose of the publication is to gather together various fundamental procedures in the electronic field and put them in a form for easy reference. Inquiries regarding the publication should be directed to Clough-Brengle Co., 2815-A West 19th St., Chicago, Ill.

◆

Hygrade Sylvania Corporation, Emporium, Pa., offers free to radio servicemen a revised edition of the Sylvania Characteristic Sheet, which contains complete operating characteristics, condensed technical information, and base diagrams for all Sylvania tubes announced up to April 1, 1937. The chart is arranged for use in a standard three-ring binder or may be opened flat for wall use at the service bench.

◆

The Tobe Deutschmann Corporation, Canton, Mass., tells about its filterettes (line filters) in an eight-page catalog which has just been released. Amateurs and others may secure copies by writing to the Tobe Deutschmann Corporation.

◆

A supplement, illustrating and describing several new items added to the line of Aladdin Polyiron radio components since the 536 technical bulletin was released several months ago, is available for free distribution. Interested "hams" should write to the Aladdin Radio Industries, Inc., 466 West Superior Street, Chicago, to secure their copies.

◆

Shure Brothers, 225 West Huron Street, Chicago, are now offering free copies of an up-to-date copy of their 1937 complete catalog. The pamphlet has been revised and shows, among other items, latest additions to the Shure Brothers' family of products.

◆

A midget radio frequency relay is completely discussed in Bulletin 507B, page 6, just issued by Ward Leonard Electric Co., Mount Vernon, N. Y. Those interested should write to Ward Leonard.

◆

Listing a complete line of dry electrolytic, wet electrolytic, and paper exact replacement condensers, the new Solar 1-R catalog also carries a.c. motor starting replacements. This catalog is companion to and supplements Solar catalog 8-S; it is available on request either from jobbers or the Solar Mfg. Corp., 599 Broadway, New York City.

BOOK REVIEW

Television Supplement

April, 1937, supplement to TELEVISION WITH CATHODE RAYS, by Arthur H. Halloran, 42 pages, for insertion into standard small-size loose-leaf binder. Published by Pacific Radio Publishing Co., Inc., and distributed by RADIO. The Supplement is not procurable separately, but sold only with complete copies of "Television With Cathode Rays" at $2.75 per copy.

The April, 1937, Supplement to *Television With Cathode Rays* is a complete insert for the book itself and covers but one principal subject: details of design, construction and operation of a complete experimental cathode-ray television receiver for the home.

The text has been carefully compiled so that the reader will be enabled to construct a satisfactory receiver for operation in such locations where television pictures are now being transmitted.

The receiver which is described in this Supplement was designed and built by Frank C. Jones. It employs the new RCA-913 cathode-ray tube and the small television picture which is received on this tube is magnified to approximately 4-inches square by means of a conventional reading-glass magnifying lens.

Numerous schematic circuit diagrams are shown; the text is carefully compiled and well presented, so that any experienced radio set builder can expect to duplicate the performance of the original model.

The renewed interest in television transmission in New York, Pennsylvania, California, Britain, Germany and elsewhere makes it essential that the experimenter equip himself with a modern television library. *"Television With Cathode Rays"* is a practical work for the serious-minded experimenter.

Telephony Handbook

AMATEUR RADIOTELEPHONY, by Frank C. Jones. First edition, first printing. 132 pages. 75c per copy. Published by Radio, Ltd., 7460 Beverly Blvd., Los Angeles, Calif.

AMATEUR RADIOTELEPHONY is the newest of technical publications for the experimenter in radiotelephony. It contains 40 pages of theory on the how and why of all the modern systems of radiotelephony, and an additional 80 pages of constructional data for building any kind of radiotelephone transmitter from 10 watts to a kilowatt. All systems of modulation are described, as are the newest class-BC amplifiers, reverse-feedback systems, modulation measuring equipment, etc., None of the data in this book has appeared in any other work by the same author.

The book also includes questions and answers for the special-privilege class-A license examination.

It is profusely illustrated with more than 100 cuts and circuit diagrams, contains some valuable tank-circuit capacity charts and new data on all-band phone antennas. A new Jones phone receiver is also described in minute detail. The chapter on audio amplification should interest every radio technician.

Electric Shaver QRM

If you have a neighbor who insists upon using an electric shaver right at the time of day you usually try to enjoy a QSO, suggest to him that he is bothering *broadcast* reception for quite a distance (which will be no lie), and that the neighbors would probably appreciate it if he would spend a dollar for a line filter. Continental Carbon makes one that works well at all but the highest frequencies, and helps some even there. It lists at $1.00, and you can add to the persuasion by offering to get one for the offending electric-shaver addict at 40% off. This is usually quite an incentive, as people have been known to buy things that they didn't even need . . . just because they had a chance to get them "wholesale". The filter is quite small—about the size of a "double socket"—and is easily attached.

WHAT DO YOU KNOW
ABOUT INSULATORS?

1. What is meta-styrene?
2. What insulators are close relatives of face powder?
3. What is Oxybenzylmethyleneglycolanhydride?
4. What is muscovy glass?
5. What is regenerated cellulose film?
6. What is caoutchouc?

Answers on Page 95.

Raising the Antenna (Power)

In spite of the fact that they now have a very excellent antenna system, the engineers of WGY predict an equivalent power gain of three times from their proposed 625 foot vertical radiator. This will be a *general coverage* gain; it will not be from the use of horizontal directivity.

Amateurs who are now using between 200 and 500 watts input would do well to give this some careful thought before spending money to raise the input power to a kilowatt. This is especially true of a phone transmitter, which represents quite a few more dollars per output watt than does a c.w. transmitter. Some very nice arrays or a rotatable signal squirter can be put up for less than $50.

In the case of a 160 meter phone transmitter, it is a good investment to spend a good portion of the amount budgeted for the transmitter on *height*. One of the most "gettin' out" 160 meter phones we know of uses but 24 watts input. But he has a couple of 105 foot sticks.

◆

Answers to Insulator Questions

1. Victron.
2. Isolantite and Steatite.
3. Bakelite.
4. Mica.
5. Cellophane.
6. Rubber.

◆

Capacity Color Code Chart

A convenient chart, of vest pocket size, illustrating the standard R.M.A. mica capacity color code, has been made available by the Cornell-Dubilier Corporation. Ask for one at your jobber's or supply house; they are free, and mighty handy to have around.

INDEX TO ADVERTISERS

BUYER'S GUIDE

Where to Buy It

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics usually may be substituted without materially affecting the performance of the unit.

●

Humes Progressive Transmitter

C_1—Cardwell MR150BS
C_2—Cardwell MR150BS
C_3—Cardwell XT210PD
C_4—Cardwell XT210PD
C_5—Cardwell XE240KD
C_6—Cardwell XG110KS
C_7—Aerovox No. 1450
C_8—Aerovox No. 1450
C_9—Aerovox No. 1456
C_{10}—Aerovox No. 1505
C_{11}—Aerovox No. 1005
C_{12}—Aerovox No. 284
C_X—Cardwell ZT30AS
C_YC_Z—Cardwell NA5NS
R_1—Ohmite—wire watt
R_2—Ohmite—Brown Devil
R_3—Ohmite—Brown Devil
R_4—Ohmite—Brown Devil
R_5—Ohmite No. 0376
R_6—Ohmite—Brown Devil
R_7—Ohmite No. 0573
R_8—Ohmite—Brown Devil
R_9—Ohmite No. 0962
R_{10}—Ohmite No. 0963
R_{11}—Ohmite No. 0418
R_{12}—Ohmite No. 0620
R_{13}—Ohmite No. 0621
RFC—Ohmite No. Z-2
T_1—General No. 1052
T_2—General No. 8008
T_3—General No. 4011
T_4—General No. 2819
T_5—General No. 2825
T_6—General No. 4013
T_7—General No. 3319
T_8—General No. 3263
T_9—General No. 8009
CH_1—General No. 2157
CH_2—General No. 2157
CH_3—General No. 2155
CH_4—General No. 2156
L_1—National XR 4
L_2—National XR 5
L_3L_4—National UR 13
L_5—Coto-Coil, TL Series
L_6—Coto-Coil, No. 20 A
Dials—Coto-Coil
Chassis—General
Relay Rack—General

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Adams Amplifier

Resistors — Continental M5 ½ watt insulated
R_6—Electrad 203 potentiometer
R_{15} — Electrad 271W potentiometer
R_{16}—Electrad 240 potentiometer (optional)
C_1,C_6,C_{10}—Aerovox PR25 25 μfd.
Other Condensers except as listed—Aerovox 484
C_{14}—Aerovox PR5 8 μfd.
Pilot light assembly — Yaxley 310
Plugs and receptacles—Amphenol
T—Oxford, 6F6 to 500 ohm line
Microphone—Turner type VT73
Cabinet—Crowe type 245, undrilled
Knobs — Crowe; one 284, two 286
Dial plates—Crowe
Sockets—Amphenol type S8